INTERNAL REVIEW
SITE ASSESSMENT GROUP CERCLIS DECISION RECORD

Site Name: Holden Landfill

CERCLIS #: MAD 980 503 570

Site Assessment Product Reviewed: (PA) (SI) (SIP) Other State Ltr.

State Coordinator: (1) Dave Smith Date: 11-18-00

SAC Reviewers: (2) Matthew Audet Date: 10/25/00

(3) _____ Date: _____

(4) _____ Date: _____

Recommended CERCLIS Decision:

Reviewer (1) (2) (3) (4) NFRAP - No Site
Reviewer (1) (2) (3) (4) NFRAP - No Waste
Reviewer (1) (2) (3) (4) NFRAP - Petroleum Only
Reviewer (1) (2) (3) (4) NFRAP - Low HRS Score
Reviewer (1) (2) (3) (4) NFRAP - Other (Explain Under Comments)
Reviewer (1) (2) (3) (4) Defer to RCRA/NRC
Reviewer (1) (2) (3) (4) Continued Investigation Under CERCLA

Comments Reviewer (1):

Low Priority Archive

Comments Reviewer (2):

Concur with LSPA.

Comments Reviewer (3):

Comments Reviewer (4):

"LOW PRIORITY SITE" ARCHIVE DECISION - EPA REGION I

Site Name: Holden Landfill **EPA ID#:** MAD980503510

Address: Wachusett River Street **City:** Holden **State:** MA

Preliminary Assessment completed:	05-01-80	**By:** MA DEP
Site Inspection completed:	05-01-82	**By:** MA DEP
Site Inspection Prioritization completed:	05-22-96	**By:** Weston START

State Archive Recommendation Letter: 06-30-00

LOW PRIORITY SITE ARCHIVE DECISION RECOMMENDED:

This site has been assigned a low priority for any further assessment, and no further federal CERCLA activities are anticipated. The state has concurred that this site is not an appropriate candidate for NPL consideration, and that any further actions which may be necessary should be pursued under state program authorities.

EPA, in consultation with the state, reserves the right to activate NPL listing activities at this site if new information becomes available or site conditions substantially change. Such significantly changed circumstances could result in a recommendation for listing at a later time.

DISCUSSION/RATIONALE:

The 15-acre landfill situated on a 25-acre property has been used for the disposal of primarily municipal wastes since 1955, though some industrial wastes have also been disposed of in the landfill. The site is regulated under the MA DEP Solid Waste program, and was closed and capped in 1991. The MA DEP Bureau of Waste Site Cleanup considers the site to be Adequately Regulated by the Solid Waste program, and has no involvement with the landfill. The Solid Waste program oversees post-closure monitoring of the landfill, including periodic air, groundwater and surface water sampling. Although some organic and inorganic contamination continues to be present in groundwater, surface water, sediment, and leachate samples (and air via the gas vents), the concentrations of contaminants have decreased since the landfill was capped, and do not exceed state action levels. No drinking water supplies are impacted by the site.

The state has confirmed to EPA (letter from Mr. Mark Baldi, MA DEP dated October 2, 2000) that all state program requirements have been met, and that there are no outstanding issues regarding the landfill. Other than continued post-closure monitoring, no further actions are required at this site by the state, which considers the landfill to be "closed". The state has recommended to EPA that this site is not an appropriate candidate for NPL consideration, and that it should be assigned a No Further federal Remedial Action Planned decision and be archived from CERCLIS.

Upon review of the available information and the state's recommendation, EPA New England concurs with the MA DEP that the state should be recognized as the lead Agency overseeing environmental compliance at this site, and that further Superfund program action is unnecessary. Should future hazardous waste issues arise at this site, they will be addressed via the state program. In recognition of the full and satisfactory closure of this site in 1991, completed in compliance with state program guidance, the Holden Landfill should be assigned a low priority site archive designation and removed from CERCLIS.

Archive Decision Recommended By:
(Site Assessment Manager)

Signature: Nancy Smith Date: 10-18-00

Archive Decision Concurrence By:
(Superfund Section Chief)

Signature: [signature] Date: 10/25/00

SITE INSPECTION WORKSHEETS
(Region I version 6/30/95)

WARNING!!
EPA has determined that the HRS score of any site that is progressing towards listing on the NPL is confidential. Deliberations regarding scoring or listing issues, the site specific status, and HRS scores cannot be released or discussed with non-Agency persons. For additional guidance see the April 30, 1993 OSWER Directive 9320.1-11.

SITE LOCATION			
Site Name: Holden Dump			
Street Address: River Street			
City: Holden	State: MA	Zip Code: 01520	Telephone: None
CERCLIS ID No.: MAD980503510	Coordinates: Latitude: 42° 22′ 40.0″ N Longitude: 71° 49′ 16.0″ W		

OWNER/OPERATOR IDENTIFICATION					
Owner: Town of Holden—Brian Bullock, Town Manager			Operator: John Westerling, Civil Engineer		
Owner Address: 1204 Main Street			Operator Address: 1204 Main Street		
City: Holden			City: Holden		
State: MA	Zip Code: 01520	Telephone: (508) 829-0225	State: MA	Zip Code: 01520	Telephone: (508)829-0246

SITE EVALUATION	
Agency/Organization: WESTON/START	TDD No.: 95-07-0013
Investigator: Brian Carter	Date: 16 May 1996

EPA CONTACT		
EPA SAM: Nancy Smith		
Address: JFK Federal Building		
City: Boston	State: MA	Zip Code: 02203
Telephone: (617) 573-9697		
EPA Reviewer:	Date:	

MAY BE RELEASED N Smith 10-26-00

GENERAL INFORMATION

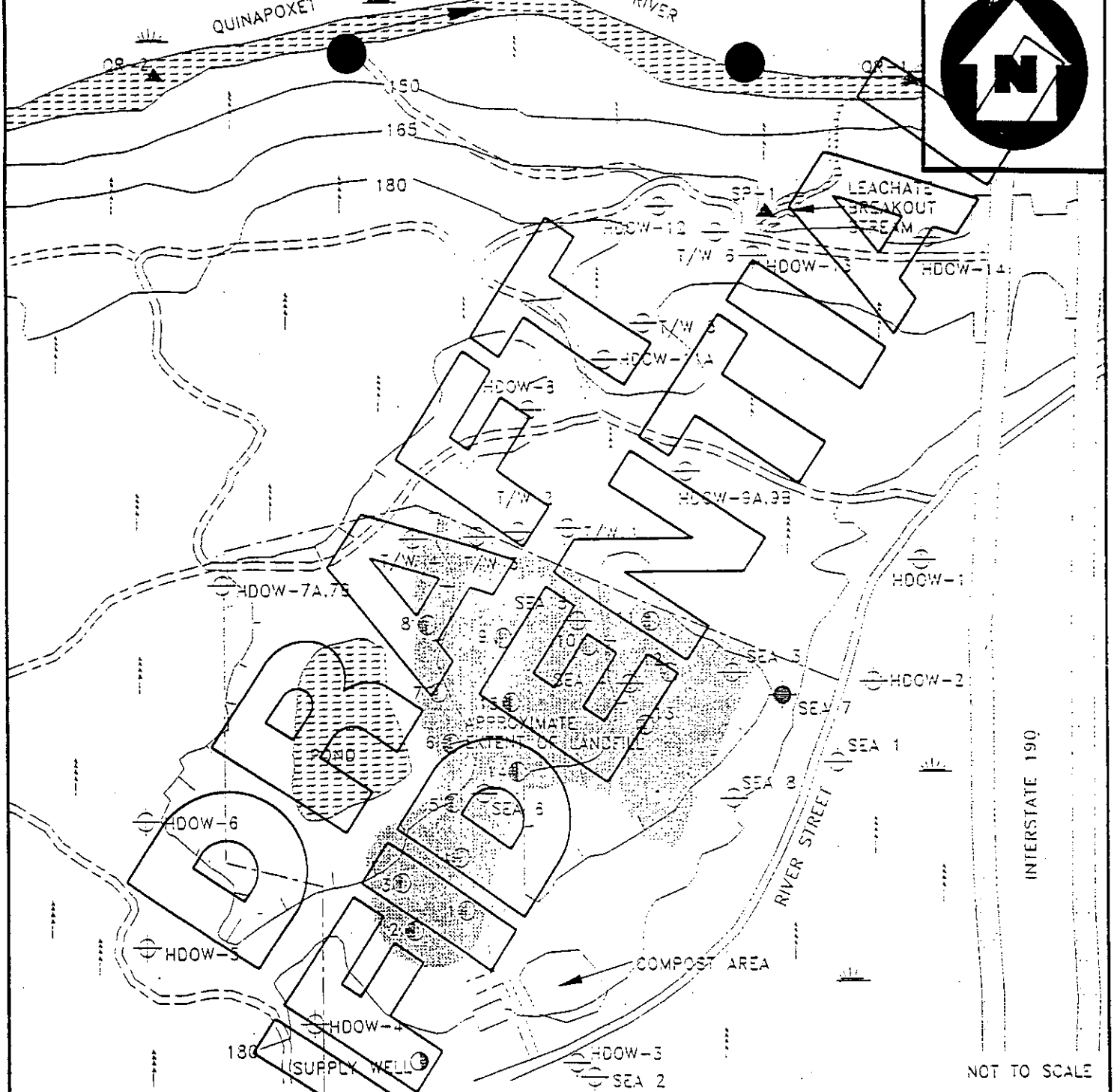
Site Description and Operational History: Provide a brief description of the site and its operational history. State the site name, owner, operator, type of facility and operations, size of property, active or inactive status, and years of waste generation. Summarize waste treatment, storage, or disposal activities that have or may have occurred at the site; note whether these activities are documented or alleged. Identify all source types and prior spills, floods, or fires. Summarize highlights of the PA and other investigations. Cite references.

The Holden Dump occupies about 15 acres on a topographic high point southwest of the intersection of Interstate 190 and the Quinapoxet River. The property is bounded to the east by River Street. A pond is located immediately west of the landfill. Immediately east of the landfill is a depression that receives runoff from part of the site and acts as a retention pond. From 1955 to 1970, the landfill was privately operated, although located on town-owned property, as an open-face burning dump. From 1970 to about 1991, the facility was a town-owned and operated municipal landfill [7, p. 1-3]. The landfill currently has a maintained cap and is undergoing post closure monitoring of air, groundwater, and surface water, which the Massachusetts Department of Environmental Protection (MA DEP) is overseeing. The Town of Holden expects to compile the monitoring results in a Comprehensive Site Assessment report to be completed for the landfill in 1996. The southwest corner of the property is used for composting yard waste collected by the town.

The Quinapoxet River flows within 1,300 feet of the southwest corner of the landfill before bending to the northwest. The Quinapoxet River changes course again and comes within 1,200 feet of the north side of the landfill. As early as 1978, a groundwater leachate stream was noted to the north of the landfill. This stream has historically been rust-colored, staining the ground it flowed over, cascading down a 25% slope into the Quinapoxet River. The Quinapoxet River then flows east into the Wachusett Reservoir, which supplies water to about 2.5 million people living in 42 communities near Boston [7, pp. 1-2, 1-3; 8].

Recent sampling events show the concentrations of organic compounds in the groundwater and leachate to be significantly reduced compared to samples collected prior to landfill closure. However, samples collected between 1993 and 1995 have shown the following:

- Arsenic concentrations in sediments samples collected from the Quinapoxet River are greater than three times background concentrations [20].
- Arsenic and vinyl chloride were present in the leachate stream in 1994 [21].
- Vinyl chloride was detected in groundwater samples collected in 1994 [21].
- Vinyl chloride was detected at all 15 gas vents that were sampled in June 1995 [23].



ADAPTED FROM: (1) ~~STERLING, MA~~, 7.5 X 15 MINUTE TOPOGRAPHIC MAP (USGS, 1988); (2) HOLDEN LANDFILL GAS-SAMPLING, FIGURE 1 (PLOSS ASSOC., 1995); (3) HOLDEN LANDFILL STUDY, FIGURE 10 (NUS CORP, 1983); AND (4) HYDROGEOLOGIC INVESTIGATION AND DESIGN OF CLOSURE, FIGURE 1-1 (SEA CONSULTANTS, 1986)

LEGEND

- TREES
- PAVED ROAD
- DIRT PATH
- SURFACE WATER
- PROPERTY BOUNDARY
- MONITORING WELL
- LANDFILL AREA
- BUILDING
- GAS VENT
- SURFACE WATER SAMPLE
- WATER SUPPLY WELL
- SOIL BORING
- WETLANDS

SITE MAP

HOLDEN LANDFILL

RIVER STREET

HOLDEN, MASSACHUSETTS

WESTON® MANAGERS DESIGNERS/CONSULTANTS

REGION I SUPERFUND TECHNICAL ASSESSMENT AND RESPONSE TEAM

TDD #	DRAWN BY:	DATE
95-07-0013	B. CARTER	10/26/95

FILE NAME:	FIGURE 2
HOLDENF2.DWG	

16 May 1996

SOURCE EVALUATION

Description of each Source: Identify each source area by name and number, and classify each source into a source type category (see SI Table 1). Describe the dimensions of each source. Identify the hazardous substances associated with each source. Determine the containment characteristics for each source by pathway (see HRS Tables 3-2, 4-2, 6-3 and 6-9).

Source No. 1 Landfill (Landfill)

The landfill was operated, in various capacities, from 1955 to 1991. No information is available on the wastes accepted between 1955 and 1970. After 1970, municipal waste was accepted, although a 1986 Massachusetts Department of Environmental Quality Engineering (MA DEQE) inspection revealed the improper disposal of special wastes and waste oil [17, p. 2]. The landfill is now capped and one corner of the property is used for composting. The maintained, engineered cap precludes soil exposure from the source. Gas vents in the cap allow the release of landfill gas to the atmosphere [14, 24].

Source #	Source Type	Pathway Availability			
		GW	SW	SE	A
Landfill	Landfill	Y	Y	N	Y

Legend: Y = available to pathway
N = not available to pathway
? = availability unknown
I = ineligible waste

SOURCE EVALUATION (Continued)

Hazardous Waste Quantity (HWQ) Calculations: SI Tables 1 and 2 (See HRS Tables 2-5, 2-6, and 5-2).

For each source, provide HWQ calculations by tier and provide assumptions. Note: HWQ calculations may be different for the soil exposure pathway.

There is insufficient information to evaluate the landfill using Tier A (*Constituent Quantity*), Tier B (*Wastestream*), or Tier C (*Volume*).

1. Landfill (Landfill)

Tier D (Area)

The landfill occupies about 15 acres, which from SI Table 1 results in a HWQ of 100.

SITE HWQ = 100

No samples establish areas of observed contamination at the site. Consequently, the hazardous waste quantity factor value for the soil exposure pathway is 0. If the entire landfill is considered an area of observed contamination: by HRS Table 5-2, the soil exposure pathway the hazardous waste quantity value is 630,000 square feet ÷ 34,000 = 19. Consequently, from HRS Table 2-6 the hazardous waste quantity factor value would be 10.

GW HWQ = 100
SW HWQ = 100
SE HWQ = 0
AIR HWQ = 100

SI TABLE 1:HAZARDOUS WASTE QUANTITY (HWQ) SCORES FOR SINGLE SOURCE SITES AND FORMULAS FOR MULTIPLE SOURCE SITES

		Single Source Sites (assigned HWQ scores)				Multiple Source Sites
Tier	Source Type	HWQ = 10	HWQ = 100	HWQ = 10,000	HWQ = 1,000,000	Divisors for Assigning Source WQ Values
A **Hazardous Constituent Quantity**	N/A	HWQ = 1 if Hazardous Constituent Quantity data are complete HWQ = 10 if Hazardous Constituent Quantity data are not complete	>100 to 10,000 lbs	>10,000 to 1 million lbs	> 1 million lbs	lbs ÷ 1
B **Hazardous Wastestream Quantity**	N/A	≤500,000 lbs	>500,000 to 50 million lbs	>50 million to 5 billion lbs	>5 billion lbs	lbs ÷ 5,000
C **Volume**	Landfill	≤6.75 million ft^3 ≤250,000 yd^3	>6.75 million to 675 million ft^3 >250,000 to 25 million yd^3	>675 million to 67.5 billion ft^3 >25 million to 2.5 billion yd^3	>67.5 billion ft^3 >2.5 billion yd^3	ft^3 ÷ 67,500 yd^3 ÷ 2,500
	Surface impoundment	≤6,750 ft^3 ≤250 yd^3	>6,750 to 675,000 ft^3 >250 to 25,000 yd^3	>675,000 to 67.5 million ft^3 >25,000 to 2.5 million yd^3	>67.5 million ft^3 >2.5 million yd^3	ft^3 ÷ 67.5 yd^3 ÷ 2.5
	Drums	≤1,000 drums	>1,000 to 100,000 drums	>100,000 to 10 million drums	>10 million drums	drums ÷ 10
	Tanks and non-drum containers	≤50,000 gallons	>50,000 to 5 million gallons	>5 million to 500 million gallons	>500 million gals.	gallons ÷ 500
	Contaminated soil	≤6.75 million ft^3 ≤250,000 yd^3	>6.75 million to 675 million ft^3 >250,000 to 25 million yd^3	>675 million to 67.5 billion ft^3 >25 million to 2.5 billion yd^3	>67.5 billion ft^3 >2.5 billion yd^3	ft^3 ÷ 67,500 yd^3 ÷ 2,500
	Pile	≤6,750 ft^3 ≤250 yd^3	>6,750 to 675,000 ft^3 >250 to 25,000 yd^3	>675,000 to 67.5 million ft^3 >25,000 to 2.5 million yd^3	>67.5 million ft^3 >2.5 million yd^3	ft^3 ÷ 67.5 yd^3 ÷ 2.5
	Other	≤6,750 ft^3 ≤250 yd^3	>6,750 to 675,000 ft^3 >250 to 25,000 yd^3	>675,000 to 67.5 million ft^3 >25,000 to 2.5 million yd^3	>67.5 million ft^3 >2.5 million yd^3	ft^3 ÷ 67.5 yd^3 ÷ 2.5

SI TABLE 1: HAZARDOUS WASTE QUANTITY (HWQ) SCORES FOR SINGLE SOURCE SITES AND FORMULAS FOR MULTIPLE SOURCE SITES

		Single Source Sites (assigned HWQ scores)				Multiple Source Sites
Tier	Source Type	HWQ = 10	HWQ = 100	HWQ = 10,000	HWQ = 10,000,000	Divisors for Assigning Source WQ Values
D Area	Landfill	≤340,000 ft² ≤7.8 acres	>340,000 to 34 million ft² >7.8 to 780 acres	>34 million to 3.4 bil. ft² >780 to 78,000 acres	>3.4 billion ft² >78,000 acres	ft² ÷ 3,400 acres ÷ 0.078
	Surface Impoundment	≤1,300 ft² ≤0.029 acres	>1,300 to 130,000 ft² >0.029 to 2.9 acres	>130,000 to 13 million ft² >2.9 to 290 acres	>13 million ft² >290 acres	ft² ÷ 13 acres ÷ 0.00029
	Contaminated Soil	≤3.4 million ft² ≤78 acres	>3.4 million to 340 million ft² >78 to 7,800 acres	>340 million to 34 bil. ft² >7,800 to 780,000 acres	>34 billion ft² >780,000 acres	ft² ÷ 34,000 acres ÷ 0.78
	Pile	≤1,300 ft² ≤0.029 acres	>1,300 to 130,000 ft² >0.029 to 2.9 acres	>130,000 to 13 million ft² >2.9 to 290 acres	>13 million ft² >290 acres	ft² ÷ 13 acres ÷ 0.00029
	Land treatment	≤27,000 ft² ≤0.62 acres	>27,000 to 2.7 million ft² >0.62 to 62 acres	>2.7 mil. to 270 million ft² >62 to 6,200 acres	>270 million ft² >6,200 acres	ft² ÷ 270 acres ÷ 0.0062

1 ton = 2,000 lbs = 1 yd³ = 4 drums = 200 gallons

SI TABLE 2: HWQ SCORES FOR MULTIPLE SOURCE SITES

Site WQ Total	HWQ Score
0	0
1[a] to 100	1[b]
>100 to 10,000	100
>10,000 to 1,000,000	10,000
>1,000,000	1,000,000

[a]If the HWQ total is between 0 and 1, round it to 1.
[b]If the hazardous constituent quantity data are not complete, assign the score of 10.

SI TABLE 3: WASTE CHARACTERIZATION WORKSHEET

Enter "NA" for substances which are not available to a pathway.
Enter "NL" for substance values not listed in SCDM.
Provide footnote for substances listed in table but not used for scoring purposes (e.g. BTEX substances attributable to a gasoline tank).

Sources:
1. Landfill

			GROUNDWATER PATHWAY		SURFACE WATER PATHWAY							
					OVERLAND/FLOOD MIGRATION							
Source	Hazardous Substance	Toxicity	GW Mobility (HRS Table 3-8)	Tox. × Mobility Value (HRS Table 3-9)	Pers. (HRS Tables 4-10 and 4-11)	Tox. × Pers. Value (HRS Table 4-12)	Bioacc. Pot. (HRS Table 4-15)	Tox. × Pers. × Bioacc. Value (HRS Table 4-16)	Ecotox. (HRS Table 4-19)	Ecotox. × Pers (HRS Table 4-20)	Eco. Bioacc. Pot. (HRS Table 4-20)	Ecotox. × Pers. × Eco. Bioacc. Value (HRS 4-21)
1	1,1-dichloroethane	10	1	10	0.4	4	5	20	NL	-	5	-
1	1,1-dichloroethylene	100	1	100	0.4	40	50	2,000	10	4	50	200
1	1,1,1-trichloroethane	1	0.01	0.01	0.4	0.4	5	2	10	4	5	20
1	1,1,2,2-tetrachloroethane	10	0.01	0.1	0.4	4	5	20	100	40	5	200
1	1,2-dichloroethane	100	1	100	0.4	40	5	200	1	0.4	5	20
1	1,2-dichloroethylene	100	1	100	0.4	40	50	2,000		0.4	50	20
1	1,2-dichloropropane	1,000	1	1,000	0.4	400	50	20000	10	10	5	50
1	Benzene	100	1	100	0.4	40	5,000	2E+05	100	40	500	20,000
1	Carbon tetrachloride	1,000	1	1,000	0.4	400	50	20,000	100	40	50	2,000
1	Dioxane	10	1	10	1	10	0.5	5	1	1	0.5	0.5
1	Ethylbenzene	10	1	10	0.4	4	50	200	100	40	50	2,000
1	Methyl ethyl ketone	10	1	10	0.4	4	0.5	2	1	0.4	0.5	0.2
1	Methyl isobutyl ketone	10	1	10	4	40	5	200	1	0.4	5	0.2
1	Tetrachloroethane	10	1	10	0.4	4	5	20	100	40	5	200
							BCF					

SCDM Version: JUL95
Notes: for 1,2-dichloroethene, used values for trans 1,2-dichloroethene for tetrachloroethane, used values for 1,1,2,2-tetrachloroethane.
Values for waste disposed of as liquid, in non-karst terrain, freshwater, and river were used.

SI TABLE 3: WASTE CHARACTERIZATION WORKSHEET
(continued)

Sources:
1. Landfill

			GROUNDWATER PATHWAY		SURFACE WATER PATHWAY							
					OVERLAND/FLOOD MIGRATION							
Source	Hazardous Substance	Toxicity	GW Mobility (HRS Table 3-8)	Tox. × Mobility Value (HRS Table 3-9)	Pers. (HRS Tables 4-10 and 4-11)	Tox. × Pers. Value (HRS Table 4-12)	Bioacc. Pot. (HRS Table 4-15)	Tox. × Pers. × Bioacc. Value (HRS Table 4-16)	Ecotox. (HRS Table 4-19)	Ecotox. × Pers (HRS Table 4-20)	Eco. Bioacc. Pot. (HRS Table 4-20)	Ecotox. × Pers. × Eco. Bioacc. Value (HRS 4-21)
1	Tetrachloroethylene	100	1	100	0.4	40	50	2,000	100	40	50	2,000
1	Toluene	10	1	10	0.4	4	50	200	100	40	50	2,000
1	Trichloroethylene	10	1	10	0.4	4	50	200	100	40	50	2,000
1	Vinyl chloride	10,000	1	10,000	0.0007	7	5	35	NL		5	-
1	Xylene	10	0.01	0.1	0.4	4	50	200	100	40	50	2,000
1	Arsenic	10,000	0.01	100	1	10,000	5	50,000	100	100	500	50,000
1	Barium	10	0.01	0.1	1	10	0.5	5	1	1	0.5	0.5
1	Beryllium	10,000	0.01	100	1	10,000	50	5E+05	NL		50	-
1	Chromium	10,000	0.01	100	1	10,000	5	50,000	10,000	10,000	5	50,000
1	Iron	1	0.01	0.01	1	1	0.5	0.5	10	10	0.5	5
1	Lead	10,000	0.01	100	1	10,000	50	5E+05	1,000	1,000	5,000	5E+06
1	Zinc	10	0.01	0.1	1	10	500	5,000	10	10	500	5,000
							BCF					

SCDM Version: JUL95
References: 7; 21
Notes: For xylenes, values for p-xylenes were used.
Values for waste disposed of as liquid, in non-karst terrain, freshwater, and river were used.

SI TABLE 3: WASTE CHARACTERIZATION WORKSHEET
(continued)

Sources:
1/ LandfNL

			GROUNDWATER PATHWAY		SURFACE WATER PATHWAY							
					OVERLAND/FLOOD MIGRATION							
Source	Hazardous Substance	Toxicity	GW Mobility (HRS Table 3-8)	Tox. × Mobility Value (HRS Table 3-9)	Pers. (HRS Tables 4-10 and 4-11)	Tox. × Pers. Value (HRS Table 4-12)	Bioacc. Pot. (HRS Table 4-15)	Tox. × Pers. × Bioacc. Value (HRS Table 4-16)	Ecotox. (HRS Table 4-19)	Ecotox. × Pers (HRS Table 4-20)	Eco. Bioacc. Pot. (HRS Table 4-20)	Ecotox. × Pers. × Eco. Bioacc. Value (HRS 4-21)
1	Acetone	10	1	10	0.4	4	0.5	2	100	40	0.5	20
1	Fluorotrichloromethane	10	1	10	0.4	4	50	200	NL	--	50	--
1	Methylene chloride	10	1	10	0.4	4	5	20	1	0.4	5	2
1	2-hexanone	1	1	1	0.4	0.4	5	2	1	0.4	5	2
1	Styrene	10	1	10	0.4	4	50	200	100	40	50	2,000
1	Antimony	10,000	0.01	100	1	10,000	0.5	5,000	100	100	5	500
1	Boron	100	1	100	1	100	0.5	50	NL	--	0.5	--
1	Cadmium	10,000	0.01	100	1	10,000	5,000	5E+07	1,000	1,000	5,000	5E+06
1	Cobalt	1	0.01	0.01	1	1	0.5	0.5	NL	--	5,000	--
1	Manganese	10,000	0.01	100	1	10,000	0.5	5,000	NL	--	50,000	--
1	Nickel	100	0.01	1	1	100	0.5	50	10	10	500	5,000
1	Mercury	10,000	0.01	100	1	10,000	50,000	5E+08	10,000	10,000	50,000	5E+08
							BCF					

SCDM Version: JUL95
References: 7; 21
Notes: Values for waste disposed of as liquid, in non-karst terrain, freshwater, and river were used.

SI TABLE 3: WASTE CHARACTERIZATION WORKSHEET
(continued)

Sources:
1. Landfill

			GROUNDWATER PATHWAY		SURFACE WATER PATHWAY							
					OVERLAND/FLOOD MIGRATION							
Source	Hazardous Substance	Toxicity	GW Mobility (HRS Table 3-8)	Tox. × Mobility Value (HRS Table 3-9)	Pers. (HRS Tables 4-10 and 4-11)	Tox. × Pers. Value (HRS Table 4-12)	Bioacc. Pot. (HRS Table 4-15)	Tox. × Pers. × Bioacc. Value (HRS Table 4-16)	Ecotox. (HRS Table 4-19)	Ecotox. × Pers (HRS Table 4-20)	Eco. Bioacc. Pot. (HRS Table 4-20)	Ecotox. × Pers. × Eco. Bioacc. Value (HRS 4-21)
1	Selenium	100	0.01	1	1	100	5,000	5E+05	1,000	1,000	5,000	5E+06
1	Thallium	100	0.0001	0.01	1	100	500	50,000	1	1	500	500
1	Vanadium	100	0.01	1	1	100	0.5	50	NL	--	0.5	--
1	Silver	100	1	100	1	100	50	5,000	1,000	1,000	50	50,000
							BCF					

SCDM Version: JUL95
References: 7; 21
Notes: Values for waste disposed of as liquid, in non-karst terrain, freshwater, and river were used.

SI TABLE 3: WASTE CHARACTERIZATION WORKSHEET
(Continued)

Sources:
1. Landfill

			SURFACE WATER PATHWAY				AIR PATHWAY		
			GROUNDWATER TO SURFACE WATER						
Source	Hazardous Substance	Toxicity	Tox. × Mob. × Pers. Value (HRS Table 4-26)	Tox. × Mob. × Pers. × Bioacc. Value (HRS Table 4-28)	Ecotox. × Mob. × Pers. Value (HRS Table 4-29)	Ecotox. × Mob. × Pers. × Bioacc. Value (HRS Table 4-30)	Gaseous/ Particulate (HRS Table 6-13) (indicate G or P)	Mobility (HRS Table 6-11, 6-12)	Tox. × Mob. Value (HRS Table 6-13)
1	1,1-dichloroethane	10	4	200	-	-	G	1	10
1	1,1-dichloroethylene	100	0.4	20	0.04	2	G	1	100
1	1,1,1-trichloroethane	1	0.4	2	4	20	G	1	10
1	1,1,2,2-tetrachloroethane	10	0.04	0.2	0.4	2	G	1	10
1	1,2-dichloroethane	100	40	200	0.4	20	G	1	100
1	1,2-dichloroethylene	100	40	2,000	0.4	20	G	1	100
1	1,2-dichloropropane	1,000	400	20,000	10	500	G	1	1,000
1	Benzene	100	40	200,000	40	20,000	G	1	100
1	Carbon tetrachloride	1,000	400	20,000	400	20,000	G	1	1,000
1	Dioxane	10	10	5	1	0.5	G	1	10
1	Ethylbenzene	10	4	200	40	2,000	G	1	10
1	Methyl ethyl ketone	10	4	2	0.5	0.2	G	1	10
1	Methyl isobutyl ketone	10	4	20	0.5	2	G	1	10
1	Tetrachloroethane	10	0.4	20	0.04	2	G	1	10

Notes: for 1,2-dichloroethene, values for trans 1,2-dichloroethene were used; for tetrachloroethane, values for 1,1,2,2-tetrachloroethane were used.

SI TABLE 3: WASTE CHARACTERIZATION WORKSHEET
(Continued)

Sources:
1. Landfill

			SURFACE WATER PATHWAY				AIR PATHWAY		
			GROUNDWATER TO SURFACE WATER						
Source	Hazardous Substance	Toxicity	Tox. × Mob. × Pers. Value (HRS Table 4-26)	Tox. × Mob. × Pers. × Bioacc. Value (HRS Table 4-28)	Ecotox. × Mob. × Pers. Value (HRS Table 4-29)	Ecotox. × Mob. × Pers. × Bioacc. Value (HRS Table 4-30)	Gaseous/ Particulate (HRS Table 6-13) (indicate G or P)	Mobility (HRS Table 6-11, 6-12)	Tox. × Mob. Value (HRS Table 6-13)
1	Tetrachloroethylene	100	40	2,000	40	2,000	G	1	100
1	Toluene	10	4	200	4	2,000	G	1	10
1	Trichloroethylene	10	4	200	4	2,000	G	1	10
1	Vinyl chloride	10,000	7	35	--	--	G	1	10,000
1	Xylene	10	0.04	2	0.4	20	G	1	10
1	Arsenic	10,000	100	5,000	0.1	5	P	8E-05	0.8
1	Barium	10	0.1	0.05	0.01	0.005	P	8E-05	0.0008
1	Beryllium	10,000	100	5,000	--	--	P	8E-05	0.8
1	Chromium	10,000	100	500	100	500	P	8E-05	0.8
1	Iron	1	0.01	0.005	0.1	0.05	P	8E-05	8E-05
1	Lead	10,000	100	5,000	10	50,000	P	8E-05	0.8
1	Zinc	10	0.1	50	0.1	50	P	8E-05	0.0008

SCDM Version: JUL95
References: 7; 21
Notes: for xylenes, values for p-xylenes were used.

SI TABLE 3: WASTE CHARACTERIZATION WORKSHEET (Continued)

Sources:
1 Landfill

			SURFACE WATER PATHWAY				AIR PATHWAY		
			GROUNDWATER TO SURFACE WATER						
Source	Hazardous Substance	Toxicity	Tox. × Mob. × Pers. Value (HRS Table 4-26)	Tox. × Mob. × Pers. × Bioacc. Value (HRS Table 4-28)	Ecotox. × Mob. × Pers. Value (HRS Table 4-29)	Ecotox. × Mob. × Pers. × Bioacc. Value (HRS Table 4-30)	Gaseous/ Particulate (HRS Table 6-13) (indicate G or P)	Mobility (HRS Table 6-11, 6-12)	Tox. × Mob. Value (HRS Table 6-13)
1	Acetone	10	4	2	40	20	G	1	10
1	Fluorotrichloromethane	10	4	200	--	--	G	1	10
1	Methylene chloride	10	4	20	0.4	2	G	1	10
1	2-hexanone	1	0.4	2	0.4	2	G	1	1
1	Styrene	10	4	200	40	2,000	G	1	10
1	Antimony	10,000	100	50	1	0.5	P	8E-05	0.8
1	Boron	100	100	50	--	--	P	8E-05	0.008
1	Cadmium	10,000	100	5E+05	10	50,000	P	8E-05	0.8
1	Cobalt	1	0.01	0.005	--	--	P	8E-05	8E-05
1	Manganese	10,000	100	50	--	--	P	8E-05	0.8
1	Nickel	100	1	0.5	0.1	0.05	P	8E-05	0.008
1	Mercury	10,000	100	5E+06	100	5E+06	G,P	0.2	2,000

SCDM Version: JUL95
References: 7; 21
Notes: Values for waste disposed of as liquid, in non-karst terrain, freshwater, and river were used.

SI TABLE 3: WASTE CHARACTERIZATION WORKSHEET
(Concluded)

Sources:
1: Landfill

			SURFACE WATER PATHWAY				AIR PATHWAY		
			GROUNDWATER TO SURFACE WATER						
Source	Hazardous Substance	Toxicity	Tox. × Mob. × Pers. Value (HRS Table 4-26)	Tox. × Mob. × Pers. × Bioacc. Value (HRS Table 4-28)	Ecotox. × Mob. × Pers. Value (HRS Table 4-29)	Ecotox. × Mob. × Pers. × Bioacc. Value (HRS Table 4-30)	Gaseous/ Particulate (HRS Table 6-13) (indicate G or P)	Mobility (HRS Table 6-11, 6-12)	Tox. × Mob. Value (HRS Table 6-13)
1	Selenium	100	1	5,000	10	50,000	P	8E-05	0.008
1	Thallium	100	0.01	500	0.0001	0.05	P	8E-05	0.008
1	Vanadium	100	1	0.5	--	--	P	8E-05	0.008
1	Silver	100	100	5,000	1,000	50,000	P	8E-05	0.008

SCDM Version: JUL95
References: 7; 21
Notes: Values for waste disposed of as liquid, in non-karst terrain, freshwater, and river were used.

GROUNDWATER PATHWAY

Pathway Description and Scoring Notes: Describe the Groundwater Migration Pathway. Include the names and brief descriptions of the aquifers underlying the site, the depth to groundwater, the locations of the nearest private and public drinking water supplies and the aquifers from which they draw, and the population relying upon groundwater drawn from within four miles of the site for their drinking water supplies.

Briefly discuss any sampling events relative to the Groundwater Pathway; provide dates of sampling events and a summary of the analytical results and whether an observed release and/or actual contamination targets were documented.

Indicate any assumptions you have made in scoring the Groundwater Pathway for this site, or any key factors which influence your scoring rationale.

HYDROGEOLOGY

The Holden Dump is situated in a glacial outwash terrace that is bordered by the Quinapoxet River to the north, west, and south. The glacial outwash terrace is a stratified formation of fine sand and silt underlying increasingly coarser sand. The east side of the property is bordered by a glacial till upland area. Wetlands are located between the upland area and the landfill. Cross sections compiled from boring logs show that the approximate lower boundary of the permeable formation slopes downward in a northwesterly direction toward the Quinapoxet River. Auger refusal, interpreted as the top of glacial till, was encountered about 50 feet beneath the top of the water table at the property and is about 50 feet higher than the Quinapoxet River on the north side of the property. The depth below ground surface that refusal was encountered varied significantly as the topography is highly variable [14, pp. 2-1, 2-4, 2-8]. The upper layers of till encountered were predominantly sandy, highly plastic tills with low permeability. The terrace underneath the landfill is composed of stratified glacial sediments, primarily fine to coarse sand with layers of fine sand and silt north near the Quinapoxet River. NUS Corporation Field Investigation Team (NUS/FIT), which conducted the Site Inspection in 1983, postulated that the landfill may have been in direct contact with groundwater.

Bedrock was encountered in one solid boring (HDOW-7) at about 70 feet below ground surface (bgs) [7, pp. 3-1, 4-2, 4-3, 4-5, and Figure 6]. Generally, the bedrock in the area of the landfill is from the Merrimack Belt, which consists of lower Devonian sediments cut by Devonian diorite, tonalite, and granites, and by the Silurian-Ordovician Newburyport complex. More specifically, the bedrock in the vicinity of the landfill is light-gray to white, medium-grained, weakly foliated muscovite-biotite granite. No bedrock formation mapped within 4-radial miles of the property exhibits karst characteristics [36].

Surface water runoff from the property drains to either the pond, wetlands east of the property, or borrow pit (which currently drains to the wetlands). A clear downward vertical groundwater gradient was measured between monitoring wells located in the wetland east of the landfill, indicating that the wetland is a significant groundwater recharge zone. The vertical component measured near the on-site pond was negligible even though the pond's surface is 9 feet higher than the seasonal high groundwater level. SEA Consultants, which has performed much of the investigative work for Holden, concluded that a relatively impermeable layer of silt or organic material had accumulated beneath the pond which prevents groundwater recharge. Groundwater has been encountered within 5 feet of the ground surface. SEA determined solid waste and groundwater (at its seasonal high) are closest, less than 4 feet apart, along the landfill's eastern

perimeter. SEA recommended that the borrow pit be equipped with an impermeable liner and an outlet to minimize groundwater recharge [14, pp. 2-5, 2-7, 2-8, 2-13 Figure 2-3]. The mean annual precipitation in Holden in about 48 inches [40].

TARGETS

An estimated 20,582 people obtain drinking water from wells within 4 miles of the property. The nearest public well is approximately 1.1 miles east of the property. Holden, Sterling, and West Boylston each are served by blended drinking water supply systems that obtain part or all of their water from groundwater wells located within 4 miles of Holden Dump. The Holden Water District (HDW) system serves 13,500 people; the Sterling Water Department (SWD) system provides water to 4,700 people; and the West Boylston Water District (WBWD) system serves 6,200 people. Three HWD groundwater wells are within 4 miles of Holden Dump. No HWD intake provides 40% or more of the system's capacity, so the population is apportioned equally among the system's four groundwater wells and one surface water intake. One of SWD's four groundwater wells, GPW No. 2, is within 4 miles of the landfill. GPW No. 2 is designated as an emergency well, but was used during the summer of 1995 and is apportioned one-quarter of the population served by SWD. The population served by WBWD is apportioned according to the relative contribution of each source, all three of which are within 4 miles of the landfill. The nearest private well is located about 0.3 miles southwest of the property. The following table summarizes the drinking water supply by public wells within 4 miles of Holden Dump.

Public Groundwater Supply Sources Within 4-Radial Miles of Holden Dump

Distance/ Direction from Site	Source Name	Location of Source	Estimated Population Served	Source Type
1.1 mi. East	WBWD, GPW No. 1	West Boylston	1,550	UN
1.5 mi. West	HWD, Quinapoxet Well	Holden	2,700	GP
1.7 mi. West	HWD, Mill Street Wells	Holden	2,700	TWF
1.8 mi. Southeast	WBWD, GPW No. 4	West Boylston	3,100	UN
1.9 mi. Northwest	HWD, Mason Road Wells	Holden	2,700	TWF
2.9 mi. Southeast	WBWD, GPW No. 5	West Boylston	1,550	UN
3.1 mi. West	HWD, Spring Street Well	Holden	2,700	GP
3.8 mi. Northeast	SWD, GPW No. 2	Sterling	1,175	UN

Notes: GP-Gravel Packed; TWF-Tubular Well Field; UN-Unknown
[25; 26; 27]

Private groundwater supplies located within 4-radial miles of the property were estimated using equal distribution calculations of U.S. Census CENTRACTS data identifying population, households, and private water wells for "Block Groups" which lie within or partially within individual radial distance rings measured from the Holden Dump property [28]. The total population which relies on groundwater within 4-radial miles of the property is estimated at 20,582 persons and is summarized in the following table.

Estimated Drinking Water Populations Served by Groundwater Sources Within 4 Miles of Holden Dump

Radial Distance From Holden Dump (miles)	Estimated Population Served by Private Wells	Estimated Population Served by Public Wells	Total Estimated Population Served by Groundwater Sources Within the Ring
0.0 to 0.25 mile	14	0	14
0.25 to 0.50 mile	49	0	49
0.50 to 1.00 mile	128	0	128
1.00 to 2.00 miles	419	12,750	13,169
2.00 to 3.00 miles	686	1,550	2,236
3.00 to 4.00 miles	1,111	3,875	4,986
TOTAL	2,407	18,175	20,582

[a]Indicate Town in which well is located.
[b]Overburden, Bedrock, or Unknown.
[25; 26; 27; 28]

GROUNDWATER INVESTIGATIONS

Groundwater samples have been collected in the vicinity of the Holden Dump from 1981 to the present. Information regarding specific chemical analysis and quality control procedures used for sampling events prior to 1982 was not contained in the available information.

In 1983, NUS/FIT supervised the installation of 18 overburden monitoring wells (at locations HDOW-1 to HDOW-14) around the perimeter of the landfill for EPA. Each soil boring advanced by NUS/FIT extended to either glacial till or bedrock [7, pp. 3-1]. NUS/FIT conducted two rounds of groundwater sampling, one during March and the other during June. The samples were analyzed under EPA's Contract Laboratory Program (CLP). Samples collected during both rounds underwent volatile organic compound (VOC) analysis and total metal analysis (the samples were unfiltered). Samples collected in March also underwent base/neutral and acid (BNA) analysis. No BNAs were detected; as a result, BNA analysis was not performed on samples collected in June. Quality control included the laboratory quality control procedures specified under CLP and collection of two pairs of duplicate samples. VOCs detected included up to 68 parts per billion (ppb) benzene and 1,140 ppb 1,1,1-trichloroethane. Organic contaminants in the groundwater were concentrated in an area north of the landfill. Metals detected included arsenic at up to 760 ppb and at up to 520 ppb lead. Metals distribution

in groundwater roughly coincided with the organic compound distribution. Elevated concentrations of some metals were also detected in HDOW-5, which is located south of the on-site pond. NUS/FIT postulated that the metals in groundwater south of the landfill were attributable to the former burning dump [7, pp. 1-1, 1-2, 3-3, 3-4, 5-1 to 5-4, and Figures 12, 13].

Monitoring wells HDOW-1 and HDOW-2 were the most upgradient wells sampled prior to 1991. The highest values for samples collected by NUS/FIT from monitoring wells HDOW-1 and HDOW-2 in 1983 were used as background all samples collected prior to 1990. For each analyte, the higher concentration detected in the two wells was used as the reference concentration. HDOW-3 was the most upgradient well sampled after 1991 [7, Figure 10].

Sample results indicate a significant decease in contaminant concentrations in groundwater at the landfill since the landfill was capped. Sampling events indicate that contaminants are concentrated north (downgradient) of the landfill, with the exception that metals have been consistently detected above background in well HDOW-5. By December 1994, organic contaminants were only detected in samples collected from well near the leachate breakout, and no organic contaminants were detected in samples collected June 1995 (though the detection limits were higher than previous rounds and vinyl chloride was not on the analyte list) [21; 22].

SI TABLE 4: GROUNDWATER OBSERVED RELEASE SUBSTANCES (BY AQUIFER)

Note: Mobility equals 1 for all observed release substances.

Sample ID (Well—Year Collected)	Hazardous Substance	Substance Concentration (ppb)	Bckgrd. ID. (Well—Year Collected)	Bckgrd. Conc. (ppb)	Tox. × Mob. = Tox.	References
T/W-1—1983	1,1-dichloroethene	11	HDOW-1—1993	5 U	10	7
HDOW-9—1983	Methylene chloride	866	HDOW-1—1983	ND B	10	7
HDOW-13—1983	Fluorotrichloromethane	10	HDOW-1—1983	10 UN	10	7
HDOW-9—1983	Acetone	3,890	HDOW-1—1983	5 JK	10	7
HDOW-9—1983	2-butanone	7,600	HDOW-1—1983	5 U	10	7
HDOW-9—1983	2-hexanone	43	HDOW-1—1983	5 U	1	7
HDOW-9—1983	2-methyl-2-pentanone	483	HDOW-1—1983	5 U	10	7
HDOW-9—1983	Styrene	3	HDOW-1—1983	5 U	10	7
HDOW-9—1983	Benzene	68	HDOW-2—1983	5	100	7
T/W-6—1983	Carbon tetrachloride	8	HDOW-2—1983	ND	1,000	7
HDOW-9—1983	1,1,1 trichloroethane	1,140	HDOW-2—1983	ND	1	7
HDOW-9—1983	1,1 dichloroethane	270	HDOW-2—1983	ND	10	7
HDOW-9—1983	1,1,2,2 tetrachloroethane	10	HDOW-2—1983	ND	10	7
HDOW-9—1983	1,1 dichloroethene	54	HDOW-2—1983	ND	10	7
HDOW-8—1983	Aluminum	365,000	HDOW-1—1983	49,200	--	7
T/W-5—1983	Ethyl benzene	35	HDOW-2—1983	ND	10	7
HDOW-9—1983	Tetrachloroethane	7	HDOW-2—1983	ND	10	7
T/W-1—1983	Toluene	114	HDOW-2—1983	ND	10	7
HDOW-9—1983	Trichloroethene	26	HDOW-2—1983	ND	10	7
HDOW-13—1983	Vinyl chloride	202	HDOW-2—1983	ND	10,000	7
T/W-5—1983	Xylene	110	HDOW-1—1983	5	10	7
HDOW-5—1983	Cobalt	305	HDOW-2—1983	67	1	7
HDOW-8—1983	Chromium	775	HDOW-1—1983	78	10,000	7
HDOW-8—1983	Barium	2,650	HDOW-1—1983	350	10	7
HDOW-8—1983	Beryllium	41	HDOW-2—1983	10	10,000	7
HDOW-12—1983	Iron	670,000	HDOW-1—1983	59,406	1	7
HDOW-12—1983	Zinc	1,430	HDOW-1—1983	325	10	7
HDOW-8—1983	Lead	520	HDOW-2—1983	84	10,000	7
HDOW-8—1983	Copper	829	HDOW-2—1983	146	--	7

SI TABLE 4: GROUND WATER OBSERVED RELEASE SUBSTANCES (BY AQUIFER) (continued)

Sample ID (Well—Year Collected)	Hazardous Substance	Substance Concentration (ppb)	Bckgrd. ID. (Well—Year Collected)	Bckgrd. Conc. (ppb)	Tox. × Mob. = Tox.	References
HDOW-8—1983	Nickel	646	HDOW-2—1983	77	106	7
HDOW-6—1983	Manganese	12,000	HDOW-2—1983	3,690	10,000	7
T/W-5—1983	Boron	1,000	HDOW-2—1983	102	100	7
HDOW-5—1983	Vanadium	581	HDOW-1—1983	200 U	100	7
T/W-6—1983	Arsenic	4,000	HDOW-2—1983	110	10,000	7
HDOW-3—1983	Antimony	32	HDOW-1—1983	20 U	10,000	7
T/W-3—1983	Selenium	2.6	HDOW-1—1983	2 U	100	7
T/W-1—1983	Thallium	23	HDOW-1—1983	10 U	100	7
HDOW-4—1983	Mercury	1.3	HDOW-1—1983	0.2 U	10,000	7
HDOW-9—1983	Cadmium	34	HDOW-1—1983	6 U	10,000	7
				Highest Value	10,000	

Notes: Based on groundwater elevation contour maps produced by NUS/FIT and SEA Consultants, Inc. in 1983 and 1986, respectively, monitoring wells HDOW-1 and HDOW-2 were selected as upgradient background wells [7, Figure 10; 14, Figure 2-8]

SI TABLE 5: GROUNDWATER ACTUAL CONTAMINATION TARGETS

Notes: Convert all results and SCDM values to ppb or µg/L.
If sum of percents calculated for I or J index is ≥ 100%, consider the well a Level I target; if sum of I or J index is < 100%, consider the well a Level II target.

Well ID: None Level I: Level II Population Served: References:

Sample ID	Hazardous Substance	Conc. (µg/L)	Benchmark Conc. (MCL or MCLG)	% of Benchmark	RfD (J Index)	% of RfD	Cancer Risk Conc. (I index)	% of Cancer Risk Conc.
			Highest Percent		Sum of Percents		Sum of Percents	

SCDM Version: JUL95
Notes: No target drinking water well samples have been collected.

GROUNDWATER PATHWAY WORKSHEET

LIKELIHOOD OF RELEASE		Score	Data Type	Refs
1.	OBSERVED RELEASE: If sampling data or direct observation support a release to the aquifer, assign a score of 550. Record observed release substances on SI Table 4.	550	+	7
2.	POTENTIAL TO RELEASE: Depth to aquifer: 5 feet. If sampling data do not support a release to the aquifer, and the site is in karst terrain or the depth to aquifer is 70 feet or less, assign a score of 500; otherwise, assign a score of 340. Optionally, evaluate potential to release according to HRS Section 3.1.2.			
	LR =	550		

TARGETS		Score	Data Type	Refs
	Are any wells part of a blended system? Yes ✓ No If yes, attach a page to show apportionment calculations. see pages 14 and 15			
3.	ACTUAL CONTAMINATION TARGETS: If analytical evidence indicates that any target drinking water well for the aquifer has been exposed to a hazardous substance from the site, evaluate the factor score for the number of people served (SI Table 5). Level I: 0 people × 10 = 0 Level II: 0 people × 1 = 0 **Total =**	0	-	
4.	POTENTIAL CONTAMINATION TARGETS: Determine the number of people served by drinking water wells for the aquifer or overlying aquifers that are not exposed to a hazardous substance from the site; record the population for each distance category in SI Table 6a or 6b. Sum the population values and multiply by 0.1.	367	+	7; 25; 26; 27
5.	NEAREST WELL: Assign a score of 50 for any Level I Actual Contamination Targets for the aquifer or overlying aquifer. Assign a score of 45 if there are Level II targets but no Level I targets. If no Actual Contamination Targets exist, assign the Nearest Well Score from SI Table 6a or 6b. If no drinking water wells exist within 4 miles, assign 0.	20	+	25; 27; 28
6.	WELLHEAD PROTECTION AREA (WHPA): If any source lies within or above a WHPA for the aquifer, or if a groundwater observed release has occurred within a WHPA, assign a score of 20; assign 5 if neither condition applies but a WHPA is within 4 miles; otherwise assign 0.	5	+	25
7.	RESOURCES: Assign a score of 5 if one or more groundwater resource applies; assign 0 if none applies. • Irrigation (5 acre minimum) of commercial food crops or commercial forage crops • Watering of commercial livestock • Ingredient in commercial food preparation • Supply for commercial aquaculture • Supply for a major or designated water recreation area, excluding drinking water use	5	-	
	Sum of Targets T =	397		

Notes: Resources value is assumed.

SI TABLE 6 (FROM HRS TABLE 3-12): VALUES FOR POTENTIAL CONTAMINATION GROUNDWATER TARGET POPULATIONS

SI Table 6a: Other Than Karst Aquifers

Distance From Site	Pop.	Nearest Well (choose highest)	POPULATION SERVED BY WELLS WITHIN DISTANCE CATEGORY												Pop. Value	Ref.
			1 to 10	11 to 30	31 to 100	101 to 300	301 to 1000	1001 to 3000	3001 to 10,000	10,001 to 30,000	30,001 to 100,000	100,001 to 300,000	300,001 to 1,000,000	1,000,000 to 3,000,000		
0 to 1/4 mile	14	20	4	17	52	164	522	1,633	5,214	16,325	52,137	163,246	521,360	1,632,455	17	28
> 1/4 to 1/2 mile	49	18	2	11	33	102	324	1,013	3,233	10,122	32,325	101,213	323,243	1,012,122	33	28
> 1/2 to 1 mile	128	9	1	5	17	52	167	523	1,669	5,224	16,684	52,239	166,835	522,385	52	28
> 1 to 2 miles	13,169	5	0.7	3	10	30	94	294	939	2,939	9,385	29,384	93,845	293,842	2,939	28; 25; 27
> 2 to 3 miles	2,236	3	0.5	2	7	21	68	212	678	2,122	6,778	21,222	67,777	212,219	212	27; 28
> 3 to 4 miles	4,986	2	0.3	1	4	13	42	131	417	1,306	4,171	13,060	41,709	130,596	417	26; 28
Nearest Well =		20												Sum =	3,670	

Notes:

GROUNDWATER PATHWAY WORKSHEET (Concluded)

WASTE CHARACTERISTICS		Score	Data Type	Does Not Apply
8.	If any Actual Contamination Targets exist for the aquifer or overlying aquifers, assign the calculated hazardous waste quantity score or a score of 100, whichever is greater; if no Actual Contamination Targets exist, assign the hazardous waste quantity score calculated for sources available to migrate to groundwater.	100	+	
9.	Assign the highest groundwater toxicity/mobility value from SI Table 3 or 4. Substance(s): Vinyl chloride / Arsenic / Lead Value: 10,000 / 10,000 / 10,000 From Table: 4 / 4 / 4	10,000	+	
10.	Multiply the groundwater toxicity/mobility and hazardous waste quantity scores. Assign the Waste Characteristics score from the table below: (from HRS Table 2-7)	32	+	

Product	WC Score	*
0	0	
>0 to <10	1	
≥10 to <100	2	
≥100 to <1,000	3	
≥1,000 to <10,000	6	
≥10,000 to <1E+05	10	
≥1E+05 to <1E+06	18	
≥1E+06 to <1E+07	32	✓
≥1E+07 to <1E+08	56	
≥1E+08 or greater	100	

*check (✓) the WC score calculated for the pathway.

WC = 32

Multiply LR by T and by WC. Divide the product by 82,500 to obtain the groundwater pathway score for each aquifer. Select the highest aquifer score. If the pathway score is greater than 100, assign 100.

GROUNDWATER PATHWAY CALCULATION: $\frac{LR \times T \times WC}{82,500}$ = 84.7

(Maximum of 100)

Notes: (550 × 397 × 32) ÷ 82,500 = 84.7

SURFACE WATER PATHWAY

Pathway Description and Scoring Notes: Describe the Surface Water Migration Pathway. Identify the nearest source area with non-zero containment for the Surface Water Pathway and the location of the PPE. Include the length of the overland segment. Describe the in-water segment up to the target distance limit noting the stream flow characteristics of each reach and the locations of drinking water intakes, fisheries and sensitive environments along the 15-mile pathway.

Briefly discuss any sampling events relative to the Surface Water Pathway; provide dates of sampling events and a summary of the analytical results and whether an observed release and/or actual contamination targets were documented.

Indicate any assumptions you have made in scoring the Surface Water Pathway for this site, or any factors which influenced your scoring rationale.

LOCAL HYDROLOGY

The surface water migration pathway begins where a leachate stream emerges on the north face of the landfill. The leachate break-out point is the probable point of entry (PPE) to surface water because this leachate stream is apparently perennial [24]. The leachate stream flows down a steep slope and into the Quinapoxet River about 300 feet upstream of the Interstate 190 bridge. During the START on-site reconnaissance, the sediments of the Quinapoxet River at and downstream of the confluence with the leachate stream were stained a rust color. From this confluence, the Quinapoxet River flows east about 1 mile into the Wachusett Reservoir. Water flows about 6.6 miles through the reservoir to the eastern most section of the reservoir near Clinton, Massachusetts. Most water exiting the reservoir is diverted by the Massachusetts District Commission (MDC) to provide drinking water for communities in the Boston area. A relatively small portion of the water exiting the reservoir feeds the Nashua River. The 15-mile downstream point is located on the Nashua River about 1.2 miles downstream of the Seven Bridge Road/Main Street Bridge in Lancaster, Massachusetts [2].

Water Bodies Along the 15-mile Downstream Pathway From Holden Dump

Surface Water Body	Descriptor	Length of Reach	Flow Characteristics (cfs)	Length of Wetlands
Leachate Stream	Minimal stream	0 to 400 feet	0.8	0 mile
Quinapoxet River	Small to moderate stream	400 feet to 1.0 mile	98	0.25 mile
Wachusett Reservoir	Moderate to large stream	1.0 to 7.6 miles	~500	0.45 mile
Nashua River	Moderate to large stream	7.6 to 15 miles	190*	0.9 mile

cfs = Cubic feet per second.

* = The reported flow rate is for a gauging station in Clinton. However, the dilution for contaminants in the Nashua River that originated at the Holden Dump must be at least as great as in the Wachusett Reservoir. [29; 30; 31; 32, p. 37]

TARGETS

The Wachusett Reservoir provides drinking water to about 2.5 million people in the greater Boston area and to about 12,500 people in Clinton. The intake is located at the east end of the reservoir about 7.6 miles downstream of the PPE [8; 29].

The Quinapoxet River, Wachusett Reservoir, and Nashua River are all recreational fisheries. Habitats for nine State-threatened or endangered species exist along the Quinapoxet River, nine border the Wachusett Reservoir or Nashua River within 15-downstream miles of the property [33]. The Quinapoxet River is assumed to be State designated area for the protection and maintenance of aquatic life under the Clean Water Act. The total length of wetlands frontage along the 15-mile downstream pathway is about 1.6 miles [30; 37; 38; 39].

SURFACE WATER INVESTIGATIONS

Samples collected from the Quinapoxet River upstream of the leachate streams are used as reference samples for samples collected from the leachate streams, the Quinapoxet River at and downstream from the leachate streams, and the on-site pond. Most of the compounds detected in surface water and sediment samples have also been detected in groundwater samples collected from the Holden Dump property. The only organic compound detected in surface water samples collected after 1991 was vinyl chloride. Vinyl chloride was also one of the only organic compounds detected in groundwater samples collected after 1991. Arsenic has consistently been detected in the leachate stream; sediment samples from the Quinapoxet River in 1993 contained significantly elevated concentrations of arsenic.

In March 1980, EPA collected a surface water samples from the Quinapoxet River at its confluence with the leachate stream. The sample contained 15 VOCs including greater than 600 ppb 1,1,1-trichloroethane, 100 ppb 1,1-dichloroethane, and 4 ppb benzene. No reference sample was collected [6, pp. 2-3, 3-3, 3-4, 3-5, 3-6].

In May 1980, EPA collected samples from the on-site pond, the Wachusett Reservoir, and the Quinapoxet River upstream of the leachate streams. Five VOCs were detected in the sample collected from the Quinapoxet River; only one concentration was quantified—1 ppb of 1,1,1-trichloroethane. No VOCs were detected in samples collected from the on-site pond, Wachusett Reservoir, or Quinapoxet River upstream of the leachate streams [6, pp. 2-3, 3-1, 3-3, 3-4, 3-5, 3-6].

SURFACE WATER PATHWAY (Continued)

During September 1982, MA DEQE collected surface water samples from the leachate stream and three points along the Quinapoxet River (upstream, at its confluence with the leachate stream, and downstream). All samples were analyzed for purgeable organics using EPA Method 624, no detection limits were reported. Quality control consisted of running laboratory blanks, duplicates, and spiking each run with a three compound internal standard (no quality control results were provided). Seventeen VOCs were detected (only 13 were quantified) in the sample collected from the leachate stream including 460 ppb 1,1-dichloroethane. No VOCs were detected in samples collected from the Quinapoxet River [10].

During April 1983, MA DEQE collected surface water samples from the Quinapoxet River. The samples were analyzed for purgeable organic compounds using Method 624, no quality control procedures were specified. No VOCs were detected [11].

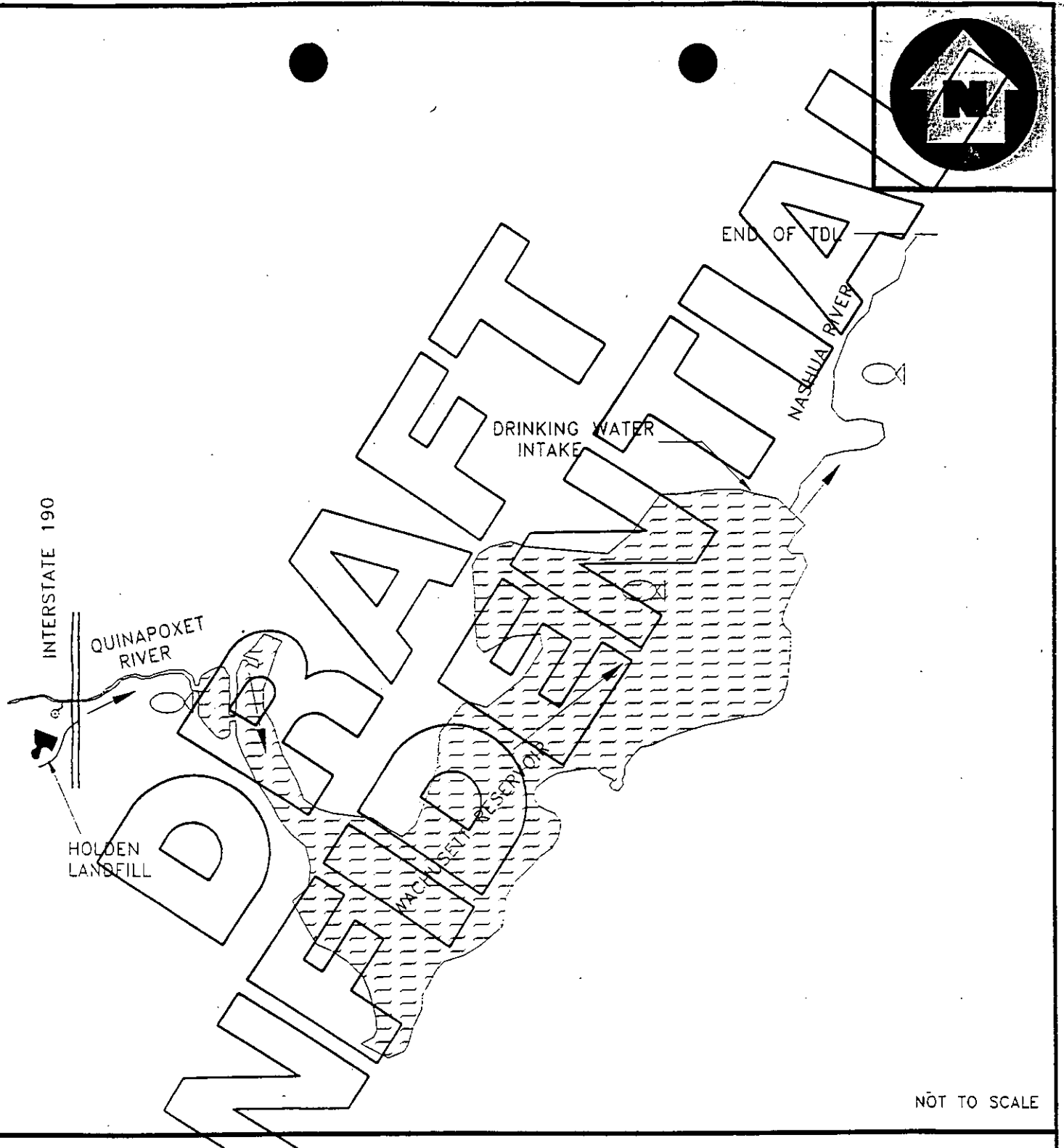
In 1983, NUS/FIT conducted two rounds of surface water sampling, the first during March and the second during June. Samples were analyzed under EPA's CLP and underwent the quality control required by that program. Samples collected during both rounds underwent analysis for VOCs and total metals (the samples were unfiltered). Samples collected in March also underwent BNA analysis. No BNA compounds were detected and, as a result, that analysis was not performed on samples collected in June. Surface water samples were collected from the Quinapoxet River (upstream and downstream), the on-site pond, an unnamed stream flowing parallel to River Street, the leachate stream, and a drainage ditch on the east side of I-190. Only the sample collected from the leachate stream, in which several VOCs were detected, contained any organic compounds. The leachate stream contained elevated concentrations of arsenic, iron, and manganese. No metals were detected at elevated concentrations in samples collected from the Quinapoxet River or the on-site pond [7, pp. 1-1, 1-2, 3-3, 3-4, 5-1 to 5-4, and Figures 12, 13].

On 30 April 1986, MA DEQE collected surface water samples from the Quinapoxet River and the leachate stream. The samples were analyzed for VOCs using EPA Method 624. Quality control procedures including analyzing a blank sample. Four VOCs, including benzene at 2 ppb, were detected in the sample collected from the leachate stream. Trichloroethylene at 1 ppb was detected in a sample from the Quinapoxet River [13].

On 14 May 1993, MDC collected three sediment samples from the Quinapoxet River; one sample from soft sediment collected upstream of the leachate stream at the confluence Quinapoxet River and Trout Brook; one sample of "red goo" from the edge of the Quinapoxet River where the leachate stream comes out of bank; and sample of organic/gravel sediment along an island in the middle of the Quinapoxet River downstream of the leachate stream. The samples at the river's confluence with the leachate stream and downstream contained 1,990 mg/kg and 30.6 mg/kg arsenic, respectively. The sample collected at the confluence also contained significantly elevated concentrations of barium and manganese [20].

SURFACE WATER PATHWAY (Continued)

During 1994 and 1995, Holden collected surface water samples from the on-site pond, up- and downstream in the Quinapoxet River, and the leachate breakout. Samples were collected quarterly and analyzed by American Environmental Laboratories, Inc. Samples were analyzed for VOCs using EPA Method 624 or 8240 and for inorganics using EPA Method Nos. 200.7, 239.2, 245.1, 206.2, and 270.2. The leachate sample collected in June 1995 was also analyzed for BNAs and pesticides/polychlorinated biphenyls by EPA Methods Nos. 8270 and 8080, respectively; none were detected. Quality control procedures included measuring surrogate recovery. Leachate samples collected in 1994 contained 1.8 ppb vinyl chloride. Surface water samples collected during June 1995 (the most recent sampling results reviewed for this report) did not contain any organic compounds (although vinyl chloride did not appear on the reported analyte list). Leachate samples contained several metals, including arsenic at 530 ppb. Several metals but no organics were detected in samples from the on-site pond. No compounds were detected in the Quinapoxet River significantly above background [21; 22].



LEGEND

- INTERSTATE
- HOLDEN LANDFILL
- RECREATIONAL FISHERY
- FLOW DIRECTION
- SURFACE WATER

SURFACE WATER MIGRATION PATHWAY

HOLDEN LANDFILL
RIVER STREET
HOLDEN, MASSACHUSETTS

WESTON® MANAGERS DESIGNERS/CONSULTANTS
REGION I SUPERFUND TECHNICAL ASSESSMENT AND RESPONSE TEAM

TDD #	DRAWN BY:	DATE
95-07-0013	B. CARTER	10/26/95

FILE NAME:	
HLF_SWF.DWG	FIGURE 2

SI TABLE 7: SURFACE WATER OBSERVED RELEASE SUBSTANCES

List all substances that meet the criteria for an observed release to surface water; however do not eliminate a substance from this table if it has a BCF of less than 500.

Sample ID	Hazardous Substance	Substance Concentration	Bckgrd. ID.	Bckgrd. Conc.	BCF HRS Table 4-15	Toxicity × Persistence	Toxicity × Persis. × Bioaccum	Ecotoxicity × Persis. × Ecobioaccum	References
LS-SP—1-1983	Benzene	11 µg/L	QR-QR-2-1983	5 U µg/L	5,000	40	2E+05	20,000	10
LS-SP-1-1983	1,1,1-trichloroethane	531 µg/L	QR-QR-2-1983	5 U	5	0.4	2	20	10
LS-007291-1982	1,1-dichloroethane	460 µg/L	QR-007295-1982	ND	50	4	200	-	10
LS-007291-1982	1,2-dichloroethylene	3.4 µg/L	QR-007293-1982	ND	50	40	2,000	20	10
LS-SP-1-1983	Toluene	31 µg/L	QR-QR-2-1983	5 U µg/L	50	4	200	2,000	7
LS-007291-1982	Ethylbenzene	16 µg/L	QR-007293-1982	ND	50	4	200	2,000	10
LS-SP-1-1983	Xylenes	21 µg/L	QR-QR-2-1983	5 U µg/L	50	4	200	2,000	7
QR-1-March, 1983	Iron	190 ppb	QR-2-March, 1983	ND	0.5	1	0.5	5	7
QR-No.4-1986	Trichloroethylene	1 µg/L	QR-No.1-1986	ND	50	4	200	2,000	13
LS-No.2-1986	Acetone	140 µg/L	QR-No.1-1986	ND	0.5	4	2	20	13
LS-No.2-1986	Methyl ethyl ketone	110 µg/L	QR-No.1-1986	ND	0.5	4	2	0.2	13
LS-No.2-1986	Methyl isobutyl ketone	4.1 µg/L	QR-No.1-1986	ND	5	40	200	0.2	13
QR-QR No. 4-1986	Methylene chloride	2 µg/L	QR-No.1-1986	ND	5	4	20	2	13
LS-007291-1982	1,1-dichloroethene	11 µg/L	LS-002293-1982	ND	50	50	40	200	13
LS-SP-1-1983	trans-1,2-dichloroethene	24 µg/L	QR-QR-2-1983	5 U µg/L	50	40	2,000	50	7
LS-SP-1-1983	Fluorotrichloromethane	10 µg/L	QR-Q2-1983	10 UN µg/L	50	4	200	--	7
QR-SED	Arsenic	1,990 mg/kg	QR-SED-1, 1993	2.97 mg/kg	5	10,000	50,000	50,000	20
LS-AA63485-1995	Chromium	29.7 mg/L	QR-1994	6 U ug/L	5	10,000	5,000	50,000	22
LS-SP-1983	Tetrachloroethane	5 ug/L	QR-QR-2-1983	5 U ug/L	5	7	20	200	7
LS-SP-1-1983	Vinyl chloride	50 ug/L	QR-QR-2-1983	5 U ug/L	5	7	35	--	7
LS-SP-2-1983	Lead	14 ug/L	QR-QR-2-1983	5 U ug/L	50	10,000	5E+05	5E+06	7
					Highest Values	10,000	2E+5	50,000	

1 Collected from "red goo" at the edge of the Quinapoxet River where the leachate stream enters the river [ref E]
2 Values for p-xylene were used.

Notes: QR- Quinapoxet River Water Sample
LS- Leachate Stream Water Sample
QR-SED - Quinapoxet River Sediment Sample
LS-SED - Leachate Stream Sediment Sample
ug/L - Quinapoxet River Sediment Sample
ppb - parts per billion

SI TABLE 8: SURFACE WATER DRINKING WATER ACTUAL CONTAMINATION TARGETS

Notes: Convert all results and SCDM values to ppb or µg/L.
If sum of percents calculated for I or J index is ≥ 100 percent, consider the intake a Level I target; if sum of I or J index is < 100 percent consider the intake a Level II target.

Intake ID: None Sample Type: Level I: Level II: Population Served: References:

Sample ID	Hazardous Substance	Conc. (µg/L)	Benchmark Conc. (MCL or MCLG)	% of Benchmark	RfD (J Index)	% of RfD	Cancer Risk Conc. (I index)	% of Cancer Risk Conc.
			Highest Percent		Sum of Percents		Sum of Percents	

SCDM Version: JUL95
Notes: The Metropolitan District Commission (MDC) periodically samples the Wachusett Reservoir and reports that no contamination attributable to the Holden Dump has been detected near the intake.

SURFACE WATER PATHWAY
LIKELIHOOD OF RELEASE AND DRINKING WATER THREAT WORKSHEET

LIKELIHOOD OF RELEASE - OVERLAND/FLOOD MIGRATION	Score	Data Type	Refs
1. OBSERVED RELEASE: If sampling data or direct observation support a release to surface water in the watershed, assign a score of 550. Record observed release substances on SI Table 7.	550		7, 21
2. POTENTIAL TO RELEASE: Distance to surface water: ~1,000 (feet) If sampling data do not support a release to surface water in the watershed, use the table below to assign a score from the table below based on distance to surface water and flood frequency.			
Distance to surface water <2500 feet	500		
Distance to surface water >2500 feet, and:			
Site in annual or 10-yr floodplain	500		
Site in 100-yr floodplain	400		
Site in 500-yr floodplain	300		
Site outside 500-yr floodplain	100		
Optionally, evaluate surface water potential to release according to HRS Section 4.1.2.1.2			
LR =	550		

LIKELIHOOD OF RELEASE - GROUNDWATER TO SURFACE WATER MIGRATION	Score	Data Type	Refs
1. OBSERVED RELEASE: If sampling data or direct observation support a release to surface water in the watershed, assign a score of 550. Record observed release substances on SI Table 7.	550	+	7, 21
NOTE: Evaluate groundwater to surface water migration only for a surface water body that meets all of the following conditions:			
1) A portion of the surface water is within 1 mile of site sources having a containment factor greater than 0.			
2) No aquifer discontinuity is established between the source and the above portion of the surface water body.			
3) The top of the uppermost aquifer is at or above the bottom of the surface water.			
Elevation of top of uppermost aquifer: ~572 feet			
Elevation of bottom of surface water body: ~460 feet		+	2
		-	2
2. POTENTIAL TO RELEASE: Depth to aquifer: 4 feet. If sampling data do not support a release to the aquifer, and the site is in karst terrain or the depth to aquifer is 70 feet or less assign a score of 500: otherwise assign a score of 340. Optionally, evaluate potential to release according to HRS Section 3.1.2.			
LR =	550		

SURFACE WATER PATHWAY
LIKELIHOOD OF RELEASE AND DRINKING WATER THREAT WORKSHEET (Continued)

DRINKING WATER THREAT TARGETS

	Score	Data Type	Refs

Record the water body type, flow, and number of people served by each drinking water intake within the distance limit in the watershed. If there is no drinking water intake within the target distance limit, assign 0 to factors 3, 4, and 5.

Intake Name	Water Body Type	Flow	People Served
MDC: Wachusett Reservoir	Lake	~500 cfs	2.5 million

Are any intakes part of a blended system? Yes ___ No ✓
If yes, attach a page to show appointment calculations. — 0 | + | 8; 20

3. ACTUAL CONTAMINATION TARGETS: If analytical evidence indicates a drinking water intake has been exposed to a hazardous substance from the site, list the intake name and evaluate the factor score for the drinking water population (SI Table 8).

Level I: 0 people × 10 = 0
Level II: 0 people × 1 = 0
Total =

4. POTENTIAL CONTAMINATION TARGETS: Determine the number of people served by drinking water intakes for the watershed that have not been exposed to a hazardous substance from the site. Assign the population values from SI Table 9. Sum the values and multiply by 0.1. — 1,632.5 | + | 8; 20

5. NEAREST INTAKE: Assign a score of 50 for any Level I Actual Contamination Drinking Water Targets for the watershed. Assign a score of 45 if there are Level II targets for the watershed, but no Level I targets. If no Actual Contamination Drinking Water Targets exist, assign a score for the intake nearest the PPE from SI Table 9. If no drinking water intakes exist, assign 0. — 0 | + | 8; 20

6. RESOURCES: Assign a score of 5 if one or more surface water resource applies; assign 0 if none applies.
- Irrigation (5 acre minimum) of commercial food crops or commercial forage crops
- Watering of commercial livestock
- Ingredient in commercial food preparation
- Major or designated water recreation area, excluding drinking water use.

5 | - |

Sum of Targets T = 1,637.5

Notes: Resources value is assumed.

SI TABLE 9 (FROM HRS TABLE 4-14): DILUTION-WEIGHTED POPULATION VALUES FOR POTENTIAL CONTAMINATION FOR SURFACE WATER MIGRATION PATHWAY[a]

Type of Surface Water Body[b]	Pop.	Nearest Intake	NUMBER OF PEOPLE								Pop. Value
			1 to 10	11 to 30	31 to 100	101 to 300	301 to 1,000	1,001 to 3,000	3,001 to 10,000	10,001 to 30,000	
Minimal Stream (<10 cfs)	0	20	4	17	53	164	522	1,633	5,214	16,325	0
Small to moderate stream (10 to 100 cfs)	0	2	0.4	2	5	16	52	163	521	1,633	0
Moderate to large stream (> 100 to 1,000 cfs)	2,512,500	0	0.04	0.2	0.5	2	5	16	52	163	16,325
Large Stream to river (>1,000 to 10,000 cfs)	0	0	0.004	0.02	0.05	0.2	0.5	2	5	16	0
Large River (> 10,000 to 100,000 cfs)	0	0	0	0.002	0.005	0.02	0.05	0.2	0.5	2	0
Very Large River (>100,000 cfs)	0	0	0	0	0.001	0.002	0.005	0.02	0.05	0.2	0
Shallow ocean zone or Great Lake (depth < 20 feet)	0	0	0	0.002	0.005	0.02	0.05	0.2	0.5	2	0
Moderate ocean zone or Great Lake (Depth 20 to 200 feet)	0	0	0	0	0.001	0.002	0.005	0.02	0.05	0.2	0
Deep ocean zone or Great Lake (depth > 200 feet)	0	0	0	0	0	0.001	0.003	0.008	0.02	0.08	0
3-mile mixing zone in quiet flowing river (≥ 10 cfs)	0	10	2	9	26	82	261	817	2,607	8,163	0

SI TABLE 9 (FROM HRS TABLE 4-14): DILUTION-WEIGHTED POPULATION VALUES FOR POTENTIAL CONTAMINATION FOR SURFACE WATER MIGRATION PATHWAY[a] (Continued)

Type of Surface Water Body	Pop.	NUMBER OF PEOPLE					Pop. Value
		30,001 to 100,000	100,001 to 300,000	300,001 to 1,000,000	1,000,001 to 3,000,000	3,000,001 to 10,000,000	
Minimal Stream (<10 cfs)	0	52,137	163,246	521,360	1,632,455	5,213,590	0
Small to moderate stream (10 to 100 cfs)	0	5,214	16,325	52,136	163,245	521,359	0
Moderate to large stream (> 100 to 1,000 cfs)	2,512,500	521	1,633	5,214	16,325	52,136	16,325
Large Stream to river (>1,000 to 10,000 cfs)	0	52	163	521	1,632	5,214	0
Large River (> 10,000 to 100,000 cfs)	0	5	16	52	163	521	0
Very Large River (>100,000 cfs)	0	0.5	2	5	16	52	0
Shallow ocean zone or Great Lake (depth < 20 feet)	0	5	16	52	163	521	0
Moderate ocean zone or Great Lake (Depth 20 to 200 feet)	0	0.5	2	5	16	52	0
Deep ocean zone or Great Lake (depth > 200 feet)	0	0.3	1	3	8	26	0
3-mile mixing zone in quiet flowing river (≥ 10 cfs)	0	26,068	81,623	260,680	816,227	2,606,795	0
						Sum =	16,325

[a]Round the number of people to nearest integer. Do not round the assigned dilution-weighted population value to nearest integer.
[b]Treat each lake as a separate type of water body and assign it a dilution-weighted population value using the surface water body type with the same dilution weight from HRS Table 4-13 as the lake. If drinking water is withdrawn from coastal tidal water or the ocean, assign a dilution-weighted population value to it using the surface water body type with the same dilution weight from HRS Table 4-13 as the coastal tidal water or the ocean zone.

SI TABLE 10: HUMAN FOOD CHAIN ACTUAL CONTAMINATION TARGETS FOR WATERSHED

Notes: Convert all results and SCDM values to µg/kg or ppb.
If sum of percents calculated for I or J index is ≥ 100%, consider the fishery a Level I target; if sum of I or J index is < 100 percent consider the fishery a Level II target. List only those substances that meet the observed release criteria in a fishery within the target distance limit and have a BCF of ≥ 500; BCF values are found on SI Table 7.

Fishery ID: Sample Type: Level I: Level II: References:

Sample ID	Hazardous Substance	Conc.	Benchmark Conc. (FDAAL)	% of Benchmark	RfD (J index)	% of RfD	Cancer Risk Conc. (I index)	% of Cancer Risk Conc.
			Highest Percent		Sum of Percents	-	Sum of Percents	-

Notes: No substances with BCF ≥500 have been detected in samples collected from fisheries.

SI TABLE 11: SENSITIVE ENVIRONMENT ACTUAL CONTAMINATION TARGETS FOR WATERSHED

Notes: Convert all results and SCDM values to µg/L or ppb.
If the highest % of benchmark calculated is ≥ 100%, consider the sensitive env. a Level I target; if the highest % of benchmark calculated is < 100% consider the sensitive env. a Level II target.

Environment ID: Quinapoxet River: Clean Water Act Sample Type: Aqueous Level I: Level II: ✓ Environment Value: 5

Sample ID	Hazardous Substance	Conc. (µg/L)	Benchmark Conc. (AWQC or AALAC)	% of Benchmark	References
QR-SW-4-1986	Trichloroethylene	1 µg/L	NE	--	2
			Highest Percent	-	

SI TABLE 11: SENSITIVE ENVIRONMENT ACTUAL CONTAMINATION TARGETS FOR WATERSHED (Concluded)

Notes: Convert all results and SCDM values to µg/L or ppb.
If the highest % of benchmark calculated is ≥ 100%, consider the sensitive env. a Level I target; if the highest % of benchmark calculated is < 100% consider the sensitive env. a Level II target.

Environment ID: Quinapoxet River: Clean Water Act Sample Type: Sediment Level I: Level II: ✓ Environment Value: 5

Sample ID	Hazardous Substance	Conc. (µg/L)	Benchmark Conc. (AWQC or AALAC)	% of Benchmark	References
QR-SED-2-1993	Arsenic	1,900 mg/kg	NA	--	13; 20
QR-SED-2-1993	Barium	508 mg/kg	NA	--	13; 20
QR-SED-2-1993	Manganese	27,300 mg/kg	NA	--	13; 20
QR-SED-2-1993	Silver	8.67 mg/kg	NA	--	13; 20
			Highest Percent	--	

SCDM Version: JUL 1995
Notes: NA = Not applicable. NE = Not established.
Reference Sample: QR-1-1986 (1 ug/L trichloroethylene [SDL is implied but not expressly stated]); QR-SED-1, 1993 (2.97 mg/kg Arsenic; 42.1 mg/kg Barium; 348 mg/kg Manganese; 0.7 U mg/kg Silver)

HUMAN FOOD CHAIN THREAT TARGETS	Score	Data Type	Refs
Record the water body type and flow for each fishery within the target distance limit. If there is no fishery within the target distance limit, assign a score of 0 at the bottom of this page.			
Fishery Name: Quinapoxet River Flow ~ 98 cfs Fishery Name: Wachusett Reservoir Flow: ~ 500 cfs Fishery Name: Nashua River Flow ~ 190 cfs Production for all fisheries is unknown but >0 lbs/year		+ + +	31; 29; 32
FOOD CHAIN INDIVIDUAL (Select highest value)			
7. ACTUAL CONTAMINATION FISHERIES: Assign 50 points for a Level I fishery only if tissue samples document an observed release of a substance with a BCF ≥ 500 to a fishery within the target distance limit (SI Table 10). List substance(s):_____. Assign 45 points for a Level II fishery if surface water/sediment samples document an observed release of a substance with a BCF ≥ 500 to a fishery within the target distance limit (SI Table 10). List substance(s):		+	18
8. POTENTIAL CONTAMINATION FISHERIES: Assign 20 points for a potential fishery if there is an observed release of a substance with a BCF ≥ 500 (SI Table 7) to a watershed containing fisheries within the target distance limit, but no Level I or Level II fisheries are scored because there is no fishery documented between the PPE and the most downstream observed release sample point. If there is no observed release of a substance with a BCF ≥ 500 to a watershed, assign a value for potential contamination fisheries from the table below using the lowest flow of all fisheries within the target distance limit.			

Lowest Flow	FCI Value
<10 cfs	20
10 to 100 cfs	2
>100 cfs, coastal tidal waters, oceans, or Great Lakes	0
3-mile mixing zone in quiet flowing river	10

FCI Value =	20	+	7
Targets T =	20		

Notes: In June 1983, NUS/FIT measured the flow rate of the Quinapoxet River to be 125 cfs. START assumed a mean annual flow rate of 98 cfs because the annual flow rate is expected to be less then the flow rate in June.

ENVIRONMENTAL THREAT WORKSHEET

When measuring length of wetlands that are located on both sides of a surface water body, sum both frontage lengths. For a sensitive environment that is more than one type, assign a value for each type.

ENVIRONMENTAL THREAT TARGETS

			Score	Data Type	Refs
Record the water body and flow for each surface water sensitive environment within the target distance limit (see SI Table 12). If there is no sensitive environment within the target distance limit, assign a score of 0 at the bottom of the page.					
Environment Type (SI Table 13)	Water Body Name	Flow			
Wetlands	Quinapoxet River	~98 cfs		+	31
Wetlands	Wachusett Reservoir and Nashua River	~500 cfs		+	29
Clean Water Act	Quinapoxet River	~98 cfs		+	31
State Threatened & Endangered Sp.	Wachusett Reservoir and Nashua River	~500 cfs		+	9

9. ACTUAL CONTAMINATION SENSITIVE ENVIRONMENTS: If sampling data or direct observation indicate any sensitive environment has been exposed to a hazardous substance from the site, record this information on SI Table 11, and assign a factor value for the environment (SI Tables 13 and 14).

Substance(s): Arsenic | Trichloroethene | Silver

From Table: 11 | 11 | 11

Environment Type (SI Table 13)	Environment Value (SI Tables 13 & 14)	Multiplier (10 for Level I, 1 for Level II)	Product
CWA	5	× 1 =	5
		× =	
		× =	
		× =	
		Sum =	5

					Score	Data Type	Refs
10. POTENTIAL CONTAMINATION SENSITIVE ENVIRONMENTS:							
Flow	Dilution weight (SI Table 12)	Environment Type and Value (SI Tables 13 & 14)	Pot. Cont.	Product			
~ 500 cfs	0.01 ×	(1.35 miles of wetland) 50 ×	0.1 =	0.05		+	30
~ 500 cfs	0.01 ×	(nine State-endangered/threatened species) 9 × 50 ×	0.1 =	0.450		-	30
~ 98 cfs	0.1 ×	(0.25 mile of wetlands) 25 ×	0.1 =	0.25		+	30
cfs	×	×	0.1 =				
				Sum =	0.75		
				Sum of Targets T =	5.75		

Notes: In June 1983, NUS/FIT measured the flow rate of the Quinapoxet River to be 125 cfs. START assumed a mean annual flow rate of 98 cfs because the annual flow rate is expected to be less then the flow rate in June.

SI TABLE 12 (HRS TABLE 4-13): SURFACE WATER DILUTION WEIGHTS

*	TYPE OF SURFACE WATER BODY		Assigned Dilution Weight
	Descriptor	**Flow Characteristics**	
	Minimal stream	< 10 cfs	1
✓	Small to moderate stream	10 to 100 cfs	0.1
✓	Moderate to large stream	> 100 to 1,000 cfs	0.01
	Large stream to river	> 1,000 to 10,000 cfs	0.001
	Large river	> 10,000 to 100,000 cfs	0.0001
	Very large river	> 100,000 cfs	0.00001
	Coastal tidal waters	Flow not applicable; depth not applicable	0.0001
	Shallow ocean zone or Great Lake	Flow not applicable; depth less than 20 feet	0.0001
	Moderate depth ocean zone or Great Lake	Flow not applicable; depth 20 to 200 feet	0.00001
	Deep ocean zone or Great Lake	Flow not applicable; depth greater than 200 feet	0.000005
	3-mile mixing zone in quiet flowing river	10 cfs or greater	0.5

* Check all (✓) appropriate dilution weights.

Notes:

SI TABLE 13 (HRS TABLE 4-23) SURFACE WATER AND AIR SENSITIVE ENVIRONMENTS VALUES

*	Sensitive Environment	Assigned Value
	Critical habitat for Federal designated endangered or threatened species Marine Sanctuary National Park Designated Federal Wilderness Area Ecologically important areas identified under the Coastal Zone Wilderness Act Sensitive Areas identified under the National Estuary Program or Near Coastal Water Program of the Clean Water Act Critical Areas identified under the Clean Lakes Program of the Clean Water Act (subareas in lakes or entire small lakes) National Monument (air pathway only) National Seashore Recreation Area National Lakeshore Recreation Area	100
	Habitat known to be used by Federal designated or proposed endangered or threatened species National Preserve National or State Wildlife Refuge Unit of Coastal Barrier Resources System Coastal Barrier (undeveloped) Federal land designated for the protection of natural ecosystems Administratively Proposed Federal Wilderness Area Spawning areas critical for the maintenance of fish/shellfish species within a river system, bay, or estuary Migratory pathways and feeding areas critical for the maintenance of anadromous fish species within river reaches or areas in lakes or coastal tidal waters in which the fish spend extended periods of time Terrestrial areas utilized by large or dense aggregations of vertebrate animals (semi-aquatic foragers) for breeding National river reach designated as recreational	75
✓	Habitat known to be used by State designated endangered or threatened species Habitat known to be used by a species under review as to its Federal endangered or threatened status Coastal Barrier (partially developed) Federally designated Scenic or Wild River	50
	State land designated for wildlife or game management State designated Scenic or Wild River State designated Natural Area Particular areas, relatively small in size, important to maintenance of unique biotic communities	25
✓	State designated areas for the protection and maintenance of aquatic life under the Clean Water Act	5
✓	Wetlands See SI Table 14 (Surface Water Pathway) or SI Table 23 (Air Pathway)	

*Check (✓) all environments impacted or potentially impacted by the site.

SI TABLE 14 (HRS TABLE 4-24): SURFACE WATER WETLANDS FRONTAGE VALUES

*	TOTAL LENGTH OF WETLANDS	ASSIGNED VALUE
	Less than 0.1 mile	0
✓	0.1 to 1 mile	25
✓	Greater than 1 to 2 miles	50
	Greater than 2 to 3 miles	75
	Greater than 3 to 4 miles	100
	Greater than 4 to 8 miles	150
	Greater than 8 to 12 miles	250
	Greater than 12 to 16 miles	350
	Greater than 16 to 20 miles	450
	Greater than 20 miles	500

* Check (✓) highest value for each applicable flow characteristic.

WASTE CHARACTERISTICS Score

11. If an Actual Contamination Target (drinking water, human food chain, or environmental threat) exists for the watershed, assign the calculated hazardous waste quantity score, or a score of 100, whichever is greater. If no Actual Contamination Targets exist, assign the hazardous waste quantity score calculated for sources available to migrate to surface water. — 100

12. Assign the highest value from SI Table 3 or SI Table 7 for the hazardous substance waste characterization factors below. Multiply each by the surface water hazardous waste quantity score and determine the waste characteristics score for each threat.

	DWT	HFCT	ET
Substance(s):	Arsenic	Benzene	Lead
Value:	10,000	2E+05	5E+06
From Table:	Table 7	Table 7	Table 3

*Footnote all substances which cannot fit on Table.

13. Multiply the toxicity and hazardous waste quantity scores. Assign the waste characteristics score for each threat from the table below.

Product	WC Score	DWT	HFCT	ET
0	0			
>0 to <10	1			
≥10 to <100	2			
≥100 to <1,000	3			
≥1,000 to <10,000	6			
≥10,000 to <1E+05	10			
≥1E+05 to <1E+06	18			
≥1E+06 to <1E+07	32	✓		
≥1E+07 to <1E+08	56		✓	
≥1E+08 to <1E+09	100			✓
≥1E+09 to <1E+10	180			
≥1E+10 to <1E+11	320			
≥1E+11 to <1E+12	560			
≥1E+12 or greater	1000			

*check (✓) the WC score calculated for each threat

	Substance Value		HWQ		Product	WC Score (from Table)	
Drinking Water Threat Toxicity/Persistence	10,000	×	100	=	1E+06	32	(Maximum of 100)
Food Chain Threat Toxicity/Persistence Bioaccumulation	2E+05	×	100	=	2E+07	56	(Maximum of 1000)
Environmental Threat Ecotoxicity/Persistence/ Ecobioaccumulation	5E+05	×	100	=	5E+08	100	(Maximum of 1000)

SURFACE WATER PATHWAY THREAT SCORES

Threat (T)	Likelihood of Release (LR) Score	Targets (T) Score	Pathway Waste Characteristics(WC) Score (determined above)	Threat Score $\frac{LR \times T \times WC}{82,500}$	
Drinking Water (DW)	550	637.5	32	100	(Maximum of 100)
Human Food Chain (HFC)	550	20	56	7.5	(Maximum of 100)
Environmental (E)	550	5.75	100	3.8	(Maximum of 60)

Multiply LR by T and by WC. Divide the product by 82,500 for each threat (T). Sum the threat scores to obtain the surface water pathway score for each watershed/migration route. Select the highest watershed/migration route score. If the pathway score is greater than 100, assign 100.

SURFACE WATER PATHWAY CALCULATION:
(DWT + HFCT + ET) = 100

(Maximum of 100)

Notes: For DWT (550 × 1,637.5 × 32) ÷ 82,5000 = 349.3, subject to a maximum value of 100. 345.4 + 7.5 + 3.83 = 360.6

SOIL EXPOSURE PATHWAY

Pathway Description and Scoring Notes: Identify all areas of observed contamination. Indicate whether a resident population is associated with the site and characterize the area surrounding the site. Identify the nearby population and any terrestrial sensitive environments located within the target distance limit.

Briefly discuss any sampling events relative to the Soil Exposure Pathway; provide dates of sampling events and a summary of the analytical results and whether an observed release and/or actual contamination targets were documented.

Indicate any assumptions you have made in scoring the Soil Exposure Pathway for this site, or any key factors which influenced your scoring rationale.

Currently, there are no confirmed areas of observed surficial soil contamination on the property. The landfill is covered with a maintained, engineered cap. Prior to closing the landfill, the wastes were available to the soil exposure pathway. The water in the leachate stream has been documented to be contaminated. The sediment of the leachate stream has not been sampled, but is visibly stained. The leachate stream is assumed to flow continuously, however its flow path likely varies dependent on its flow rate and local conditions possibly exposing contaminated soil. Currently, no person lives on the property. Three people work part-time on the property to maintain the composting operations. No person lives or works within 200 feet of the leachate stream. About 668 people live within one mile of the property [28].

With no areas of observed contamination established, the likelihood of release, waste characteristics, and target factor values are zero for both the resident population threat and nearby population threat.

SI TABLE 15a: SOIL EXPOSURE OBSERVED CONTAMINATION SUBSTANCES

Source ID:

Sample ID	Hazardous Substance	Substance Concentration	Bckgrd. ID.	Bckgrd. Conc.	Toxicity	References
None						
				Highest Toxicity		

Notes: No surficial soil samples have been collected.

SI TABLE 15b: SOIL EXPOSURE RESIDENT POPULATION TARGETS

Notes: Convert all results and SCDM values to µg/kg or ppb.
If sum of percent calculated for I or J index is ≥ 100%, consider residents Level I targets; if sum of I or J index is < 100%, consider the residents Level II targets.

Residence ID: Level I: Level II: Population:

Sample ID	Hazardous Substance	Conc. (µg/kg)	RfD (J index)	% of RfD	Cancer Risk Conc. (I index)	% of Cancer Risk Conc.	References
None							
			Sum of Percents		Sum of Percents		

Residence ID: Level I: Level II: Population:

Sample ID	Hazardous Substance	Conc. (µg/kg)	RfD (Index)	% of RfD	Cancer Risk Conc. (Index)	% of Cancer Risk Conc.	References
None							
			Sum of Percents		Sum of Percents		

SCDM Version: JUL95
Notes: There are no on-site residents.

SOIL EXPOSURE PATHWAY WORKSHEET
RESIDENT POPULATION THREAT

LIKELIHOOD OF EXPOSURE		Score	Data Type	Refs
1.	OBSERVED CONTAMINATION: If evidence indicates presence of observed contamination (depth of 2 feet or less), assign a score of 550; otherwise, assign a 0. Note that a likelihood of exposure score of 0 results in a soil exposure pathway score of 0.	0		
	LE=	0		

TARGETS

2.	RESIDENT POPULATION: Determine the number of people occupying residences or attending school or day care on contaminated property and within 200 feet of areas of observed contamination (HRS section 5.1.3). Level I: 0 people × 10 = 0 Level II: 0 people × 1 = 0 **Sum=**	0	+	24
3.	RESIDENT INDIVIDUAL: Assign a score of 50 if any Level I resident population exists. Assign a score of 45 if there are Level II targets but no Level I targets. If no resident population exists (i.e., no Level I or Level II targets), assign 0 (HRS Section 5.1.3).	0	+	24
4.	WORKERS: Assign a score from the table below for the total number of workers at the site and nearby facilities and within areas of observed contamination associated with the site.			

Number of Workers	Score
0	0
1 to 100	5
101 to 1,000	10
>1,000	15

		0	+	24
5.	TERRESTRIAL SENSITIVE ENVIRONMENTS: Assign a value for each terrestrial sensitive environment (SI Table 16) in an area of observed contamination.			

Terrestrial Sensitive Environment Type	Value
Sum =	

		0	+	24;33
6.	RESOURCES: Assign a score of 5 if any one or more of the following resources is present on area of observed contamination at the site; assign 0 if none applies. • Commercial agriculture • Commercial silviculture • Commercial livestock production or commercial livestock grazing	0	+	24
	Sum of Targets T=	0		

Notes:

SOIL EXPOSURE PATHWAY WORKSHEET
NEARBY POPULATION THREAT

LIKELIHOOD OF EXPOSURE		Score	Data Type	Ref.
7.	Attractiveness/Accessibility (from SI Table 17 or HRS Table 5-6) Value: 0			24
	Area of Contamination (from SI Table 18 or HRS Table 5-7) Value: 0		+	24
	Likelihood of Exposure (from SI Table 19 or HRS Table 5-8) LE=	0		

TARGETS		Score	Data Type	Ref.
8.	Assign a score of 0 if Level I or Level II resident individual has been evaluated or if no individuals live within 1/4 mile travel distance of an area of observed contamination. Assign a score of 1 if nearby population is within 1/4 mile travel distance and no Level I or Level II resident population has been evaluated.	0	+	24;28
9.	Determine the population within 1 mile travel distance that is not exposed to a hazardous substance from the site (i.e., properties that are not determined to be Level I or Level II); record the population for each distance category in SI Table 20 (HRS Table 3-10). Sum the population values and multiply by 0.1.	0	+	28
	Sum of Targets T=	0		

Notes:

SI TABLE 16 (HRS TABLE 5-5): SOIL EXPOSURE PATHWAY TERRESTRIAL SENSITIVE ENVIRONMENT VALUES

*	TERRESTRIAL SENSITIVE ENVIRONMENT	ASSIGNED VALUE
	Terrestrial critical habitat for Federal designated endangered or threatened species National Park Designated Federal Wilderness Area National Monument	100
	Terrestrial habitat known to be used by Federal designated or proposed threatened or endangered species National Preserve (terrestrial) National or State terrestrial Wildlife Refuge Federal land designated for protection of natural ecosystems Administratively proposed Federal Wilderness Area Terrestrial areas utilized by large or dense aggregations of animals (vertebrate species) for breeding	75
	Terrestrial habitat used by State designated endangered or threatened species Terrestrial habitat used by species under review for Federal designated endangered or threatened status	50
	State lands designated for wildlife or game management State designated Natural Areas Particular areas, relatively small in size, important to maintenance of unique biotic communities	25

* - Check (✓) all environments impacted or potentially impacted by the site.

Notes:

SI TABLE 17 (HRS TABLE 5-6); ATTRACTIVENESS/ACCESSIBILITY VALUES

*	AREA OF OBSERVED CONTAMINATION	ASSIGNED VALUE
	Designated recreational area	100
	Regularly used for public recreation (for example, vacant lots in urban area)	75
	Accessible and unique recreational area (for example, vacant lots in urban area)	75
	Moderately accessible (may have some access improvements-for example, gravel road) with some public recreation use	50
	Slightly accessible (for example, extremely rural area with no road improvement) with some public recreation use	25
✓	Accessible with no public recreation use	10
	Surrounded by maintained fence or combination of maintained fence and natural barriers	5
	Physically inaccessible to public, with no evidence of public recreation use	0

* Check (✓) highest value.

SI TABLE 18 (HRS TABLE 5-7): AREA OF CONTAMINATION FACTOR VALUES

*	TOTAL AREA OF THE AREAS OF OBSERVED CONTAMINATION (SQUARE FEET)	ASSIGNED VALUE
	≤ to 5,000	5
	> 5,000 to 125,000	20
	> 125,000 to 250,000	40
	> 250,000 to 375,000	60
	> 375,000 to 500,000	80
	> 500,000	100

* Check (✓) highest value.

Notes: There are no areas of observed contamination.

SI TABLE 19 (HRS TABLE 5-8): NEARBY POPULATION LIKELIHOOD OF EXPOSURE FACTOR VALUES

Area of Contamination Factor Value	Attractiveness/Accessibility Factor Value						
	100	75	50	25	10	5	0
100	500	500	375	250	125	50	0
80	500	375	250	125	50	25	0
60	375	250	125	50	25	5	0
40	250	125	50	25	5	5	0
20	125	50	25	5	5	5	0
5	50	25	5	5	5	5	0

SI TABLE 20 (HRS TABLE 5-10): DISTANCE-WEIGHTED POPULATION VALUES FOR NEARBY POPULATION THREAT

Travel Distance Category (miles)	Pop.	NUMBER OF PEOPLE WITHIN THE TRAVEL DISTANCE CATEGORY												Pop. Value
		0	1 to 10	11 to 30	31 to 100	101 to 300	301 to 1,000	1,001 to 3,000	3,001 to 10,001	10,001 to 30,000	30,001 to 100,000	100,001 to 300,000	300,001 to 1,000,000	
Greater than 0 to 1/4	0	0	0.1	0.4	1.0	4	13	41	130	408	1,303	4,081	13,034	0
Greater than 1/4 to 1/2	203	0	0.05	0.2	0.7	2	7	20	65	204	652	2,041	6,517	2
Greater than 1/2 to 1	465	0	0.02	0.1	0.3	1	3	10	33	102	326	1,020	3,258	3
													Sum =	5

References: [ref R]
Notes: Population does not include the 3 people who work part time on site.

SOIL EXPOSURE PATHWAY WORKSHEET (Concluded)

WASTE CHARACTERISTICS

		Score
10.	Assign the hazardous waste quantity score calculated for soil exposure	0
11.	Assign the highest toxicity value from SI Table 15a. Substance(s): _____ _____ _____ Value: _____ _____ _____ From Table: _____ _____ _____	0
12.	Multiply the toxicity and hazardous waste quantity scores. Assign the Waste Characteristics score from the table below:	

Product	WC Score	*
0	0	✓
>0 to <10	1	
≥10 to <100	2	
≥100 to <1,000	3	
≥1,000 to <10,000	6	
≥10,000 to <1E+05	10	
≥1E+05 to <1E+06	18	
≥1E+06 to <1E+07	32	
≥1E+07 to <1E+08	56	
≥1E+08 or greater	100	

*check (✓) the WC score calculated for the pathway

WC = 0

RESIDENT POPULATION THREAT SCORE:

(Likelihood of Exposure, Question 1;
Targets = Sum of Questions 2, 3, 4, 5, 6)

$\frac{LE \times T \times WC}{82,500}$ = 0

NEARBY POPULATION THREAT SCORE:

(Likelihood of Exposure, Question 7;
Targets = Sum of Questions 8,9)

$\frac{LE \times T \times WC}{82,500}$ = 0

SOIL EXPOSURE PATHWAY CALCULATION:

Resident Population Threat + Nearby Population Threat = 0

(Maximum of 100)

Notes: **SCORING ALTERNATIVE SCENARIOS:**

The entire 15-acre landfill is considered an area of observed contamination. Using the surface area of the landfill for observed contamination and lead as a hazardous substance affects the pathway score as follows: (1) people do work within 200 feet of the landfill; (2) the waste characteristics value for both threats becomes 18; (3) the likelihood of release values become 550 and 375 for the resident and nearby population threat scores, respectively; and (4) the target factor values become 5 and 0.6 for the resident and nearby population threat scores, respectively.

Resident Population Threat Score: $(550 \times 5 \times 18) \div 82,500 = 0.60$
Nearby Population Threat Score: $(375 \times 0.5 \times 18) \div 82,500 = 0.04$
Soil Exposure Pathway Calculation: $0.60 + 0.05 = 0.64$

AIR MIGRATION PATHWAY

Pathway Description and Scoring Notes: Describe the Air Migration Pathway. Identify the nearest potential receptors of airborne contaminants and the population residing within four miles of the site. Identify any sensitive environments located within the target distance limit.

Briefly discuss any sampling events relative to the Air Pathway; provide dates of sampling events and a summary of the analytical results and whether an observed release and/or actual contamination targets were documented.

Indicate any assumptions you have made in scoring the Air Pathway for this site, or any key factors which influenced your scoring rationale.

On 20 June 1995, air samples were collected from each of 15 gas vents at the landfill. Samples were collected by inserting a monitoring probe into the vent for two minutes and recording the highest concentration. Each sample contained between 1 and 5.3 parts per million (ppm) of vinyl chloride. Previous gas vent samples have contained up to 42 ppm vinyl chloride and as much as 8 ppm hydrogen sulfide [23, p. 1, Figures 2, 3, and 4, and Appendix A]. During the START site reconnaissance, air monitoring with a flame ionization detector measured over 1,000 units of organic vapors in the vicinity of the air vents [24]. The vent sample results and ambient air monitoring taken together support an observed release to air by direct observation. These air samples document targets within the 0- to 0.25-mile distance ring as subject to level II contamination (because no analytical ambient air samples have quantified contaminant concentrations). Three people work part-time on site, no person lives within 0.25 miles of the property. About 9 acres of wetlands are within 0.25 miles of the property.

The nearest residence is about 0.3 miles southwest of the property. An estimated 25,180 people live within 4 miles of the property [28].

SI TABLE 21a: AIR PATHWAY OBSERVED RELEASE SUBSTANCES

Note: Mobility equals 1 for all observed release substances.

Sample ID (vent no.—date)	Hazardous Substance	Substance Concentration	Bckgrd. ID.	Bckgrd. Conc.	Gaseous or Particulate	Tox. × Mob. = Tox.	References
14—March 1995	Vinyl chloride	42 ppm	11-March 1995	ND	G	10,000	[23]
10—September 1994	Methane	90,275 ppm	11-September 1994	12,242	G	NA	[23]
3—September 1994	Hydrogen Sulfide	8 ppm	11-September 1994	ND	G	10,000	[23]
					Highest Value	10,000	

ND = Not detected

Notes: No representative background air samples have been collected. The samples from air vent no. 11, which consistently contained lower concentrations then samples collected at other vents, was used as the background sample. These sample results do not, by themselves, support an observed release to air because they were collected in the vents. However, when combined with the air monitoring results (>1,000 ppm) during the site reconnaissance, an observed release to air is established by direct observation.

SI TABLE 21b: AIR PATHWAY ACTUAL CONTAMINATION TARGETS

Note: Convert all results and SCDM values to $\mu g/m^3$ or ppb.
If sum of percents calculated for I or J index is $\geq$ 100%, consider the targets as Level I; if the sum of I or J index is < 100% consider the targets as Level II.

Sample ID: - Level I: ✓ Level II: Distance from Sources (mi): References:

Hazardous Substance	Conc. ($\mu g/m^3$)	Toxicity/ Mobility	Benchmark Conc. (NAAQS or NESHAPS)	% of Benchmark	RfD (I index)	% of RfD	Cancer Risk Conc. (J index)	% of Cancer Risk Conc.
	Highest Tox./ Mobility		Highest Percent		Sum of Percents		Sum of Percents	

Note: No ambient air samples have been collected.

AIR PATHWAY WORKSHEET

LIKELIHOOD OF RELEASE	Score	Data Type	Refs
1. OBSERVED RELEASE: If sampling data or direct observation support a release to air, assign a score of 550. Record observed release substances on SI Table 21.	550	+	23
2. POTENTIAL TO RELEASE: If sampling data do not support a release to the air, assign a score of 500. Optionally, evaluate air migration gaseous and particulate potential to release (HRS Section 6.1.2).			
LR =	550		

TARGETS	Score	Data Type	Refs
3. ACTUAL CONTAMINATION POPULATION: Determine the number of people within the target distance limit subject to exposure from a release of a hazardous substance to the air. Level I: 0 people × 10 = 0 Level II: 0 people × 1 = 0 Total =	0	+	24
4. POTENTIAL TARGET POPULATION: Determine the number of people within the target distance limit not subject to exposure from a release of a hazardous substance to the air using SI Table 22. Sum the values and multiply by 0.1	8.4	+	28
5. NEAREST INDIVIDUAL: Assign a score of 50 if there are any Level I targets. Assign a score of 45 if there are Level II targets but no Level I targets. If no Actual Contamination Population exists, assign the Nearest Individual score from SI Table 22.	2	+	24;28
6. ACTUAL CONTAMINATION SENSITIVE ENVIRONMENTS: Sum the sensitive environment values (SI Table 23) and wetland acreage values (SI Table 23) for environments subject to exposure from the release of a hazardous substance to the air.	0	+	30
7. POTENTIAL CONTAMINATION SENSITIVE ENVIRONMENTS: Use SI Table 24 to evaluate sensitive environments not subject to exposure from a release.	2.02	-	30
8. RESOURCES: Assign a score of 5 if one or more air resources applies within 1/2 mile of a source: assign a 0 if none applies • Commercial agriculture • Commercial silviculture • Major or designated recreation area	5	-	
Sum of Targets T =	17.42		

Sensitive Environment Type	Value
Wetland Acreage	**Value**
-	

Notes: Resource value assumed.

AIR PATHWAY WORKSHEET (Concluded)

WASTE CHARACTERISTICS

		Score
9.	If any Actual Contamination Targets exist for the air pathway, assign the calculated hazardous waste quantity score or a score of 100, whichever is greater; if there are no Actual Contamination Targets for the air pathway, assign the calculated HWQ score for sources available for air migration.	100
10.	Assign the highest air toxicity/mobility value from SI Table 21a or SI Table 3.	10,000

Substance(s):	Vinyl Chloride	Hydrogen Sulfide	Mercury
Value:	10,000	10,000	2,000
From Table:	21a	21a	3

11. Multiply the toxicity and hazardous waste quantity scores. Assign the Waste Characteristics score from the table below:

Product	WC Score	*
0	0	
>0 to <10	1	
≥10 to <100	2	
≥100 to <1,000	3	
≥1,000 to <10,000	6	
≥10,000 to <1E+05	10	
≥1E+05 to <1E+06	18	
≥1E+06 to <1E+07	32	✓
≥1E+07 to <1E+08	56	
≥1E+08 or greater	100	

*check (✓) the WC score calculated for the pathway

WC = 32

Multiply LR by T and by WC. Divide the product by 82,500 to obtain the air migration pathway score. If the pathway score is greater than 100, assign 100.

AIR MIGRATION PATHWAY CALCULATION:

$$\frac{LE \times T \times WC}{82,500} = 3.72$$

(Maximum of 100)

Notes: (550 × 17.42 × 32) ÷ 82,500 = 3.72

Alternative Scenarios: If the air samples collected from within the vents are not considered to represent an observed release to the atmosphere the score becomes (500 × 17.42 × 32) ÷ 82,500 = 3.38.

SI TABLE 22 (FROM HRS TABLE 6-17): VALUES FOR POTENTIAL CONTAMINATION AIR TARGET POPULATIONS

Distance From Site	Pop.	Nearest Individual (choose highest)	NUMBER OF PEOPLE WITHIN THE DISTANCE CATEGORY												Pop. Value
			1 to 10	11 to 30	31 to 100	101 to 300	301 to 1000	1001 to 3000	3001 to 10,000	10,001 to 30,000	30,001 to 100,000	100,001 to 300,000	300,001 to 1,000,000	1,000,000 to 3,000,000	
On a source	0	20	4	17	53	164	522	1,633	5,214	16,325	52,137	163,246	521,360	1,632,455	0
0 to 1/4 mile	0	*	1	4	13	41	131	408	1,304	4,081	13,034	40,812	130,340	408,114	0
> 1/4 to 1/2 mile	203	2	0.2	0.9	3	9	28	88	282	882	2,815	8,815	28,153	88,153	9
> 1/2 to 1 mile	465	1	0.06	0.3	0.9	3	8	26	83	261	834	2,612	8,342	26,119	8
> 1 to 2 miles	4,506	0	0.02	0.09	0.3	0.8	3	8	27	83	266	833	2,659	8,326	27
> 2 to 3 miles	9,913	0	0.009	0.04	0.1	0.4	1	4	12	38	120	375	1,199	3,755	12
> 3 to 4 miles	10,093	0	0.005	0.02	0.07	0.2	0.7	2	7	28	73	229	730	2,285	28
	Nearest Individual =	20												**Sum =**	84

*Score = 20 if the Nearest Individual is within 1/8 mile of a source; score = 7 if the Nearest Individual is between 1/8 and 1/4 mile of a source.

References: 28
Notes: Nearest individual is located 0.3 miles southwest of the property [2;24].

SI TABLE 23 (HRS TABLE 6-18): AIR PATHWAY VALUES FOR WETLAND AREA

*	WETLAND AREA	ASSIGNED VALUE
	< 1 acre	0
✓	1 to 50 acres	25
	> 50 to 100 acres	75
	> 150 to 200	175
✓	> 200 to 300	250
	> 400 to 500	450
✓	> 500 acres	500

* Check (✓) highest value.

SI TABLE 24: DISTANCE WEIGHTS AND CALCULATIONS FOR AIR PATHWAY POTENTIAL CONTAMINATION SENSITIVE ENVIRONMENTS

DISTANCE	DISTANCE WEIGHT	SENSITIVE ENVIRONMENT TYPE AND VALUE (FROM SI TABLES 13 AND 23)	PRODUCT
On a Source	0.10	×	
		×	
0 to 1/4 mile	0.025	× 25 (wetland-9 acres)	0.625
		×	
1/4 to 1/2 mile	0.0054	× 25 (wetland-12 acres)	0.135
		× 5 (CWA)	0.77
1/2 to 1 mile	0.0016	× 125 (wetland-110 acres)	0.2
		×	
		×	
1 to 2 miles	0.0005	× 250 (wetland-260 acres)	0.125
		×	
2 to 3 miles	0.00023	× 350 (wetland-~350 acres)	0.081
		×	
3 to 4 miles	0.00014	× 300 (wetland-~510 acres)	0.07
		× 100 (2 state end. spec.)	0.014
> 4 miles	0	×	
		Total Environments Score =	2.02

Notes:

SITE SCORE CALCULATION	S	S^2
GROUNDWATER PATHWAY SCORE (S_{GW})	84.7	7,174.09
SURFACE WATER PATHWAY SCORE (S_{SW})	100.0	10,000.0
SOIL EXPOSURE PATHWAY SCORE(S_{SE})	0	0
AIR PATHWAY SCORE (S_A)	3.72	13.84
SITE SCORE $\sqrt{\frac{S_{GW}^2 + S_{SW}^2 + S_{SE}^2 + S_A^2}{4}} =$		65.55

COMMENTS:

WARNING!!
EPA has determined that the HRS score of any site that is progressing towards listing on the NPL is confidential. Deliberations regarding scoring or listing issues, the site specific status, and HRS scores cannot be released or discussed with non-Agency persons. For additional guidance see the April 30, 1993 OSWER Directive 9320.1-11.

HOLDEN DUMP
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